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NATURAL RESOURCES



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NATURAL RESOURCES STUDY FOR
ALACHUA COUNTY, FLORIDA
1975

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NATURAL RESOURCE STUDY

NATURAL RESOURCES STUDY
FOR
ALACHUA COUNTY, FLORIDA

INTRODUCTION

General Scope and Purpose

Residents of Florida depend on natural resources for many services such as water supply, flood control, purification of waste, recreation, esthetics, fish and game propagation. Moreover, if agricultural resources are included, then we depend upon this resource for our food supply. Too often in the past the spread of urban communities has resulted in the alteration of natural systems in preference to artificial systems which are often much more expensive in terms of time, money, energy and materials, and often with debatable success. A small but excellent example could be cited as the destruction of large shade trees in a development prior to constructing air conditioned homes.

In addition, many times in the past, planning projects have been based on economic, engineering and other concepts that have considered natural or environmental processes as only incidental to the primary project. In the frequent conflicts between conservation and development, conservation has infrequently won, not so much because decision makers pay no heed to environmental issues but because environmental concepts are often complex and difficult to comprehend in their entirety and their long term abuses and problems are difficult to quantify and defend.

One result has been the destruction of irreplaceable resources and the creation of ecological imbalances with potential immediate and future consequences. Examples of such lack of environmental awareness in development projects would include the filling of wetlands thereby destroying important wildlife habitats and areas which formerly aided in controlling flood waters. As a result of earlier inadequacies planners have become increasingly aware that systematic analyses of the total environment and its processes are an essential part of the overall planning process and that efforts to maintain or improve environmental quality must be given their due weight in land use allocation decisions. This report provides one step toward filling that need.

It is obvious then that provisions for human well being and the maintenance of a high standard of living depend in large part upon the effective utilization of our natural resources. For Alachua County, an evaluation of natural resources is an essential element in the overall planning concept when viewed in terms of its intimate relationship to the development of long range plans for managing land and water resources. This study represents an effort to compile basic data on natural systems in the county for input into the comprehensive land use planning process. The suitability maps contained herein are not land use maps but only depict natural systems. However, their inclusion into the comprehensive planning process, which serves to optimize the compatibility of different land uses, is essential in order to insure stable long-term productivity of the land.

Recently, interest in energy values or benefits of natural systems have become singularly important because of the almost certain limitation of energy, or at least the unavailability of cheap energy in future years. This limitation may have overwhelming significance to the quality of life as we know it in Florida. The conveniences we now enjoy and business activities now employed may not be possible, acceptable or practical in a steady state or declining period of energy availability. This problem with energy strongly suggests that our land use policies, life styles, and industry must be ordered in a direction oriented toward the utilization of a minimum of supplied energy, therefore requiring maximum use of our natural life support systems. This effort also lends support to land use planning since it serves to mandate land use activities compatible with natural systems.

Methodology

Because the interactions between man and his environment are numerous, subtle and complex, there are almost no simple solutions to problems involving natural resources. Due to the difficulty in envisioning these interrelations, it was necessary to employ a systems or whole-picture approach for comparing, visualizing and evaluating the complex associations between the principal natural resources in the county. Therefore, an overlay technique, similar to that promulgated by McHarg (1969), has been utilized in this report to compare and describe the county's geology, water, soils, vegetation, wildlife and other resources. This method involves a number of brief reports and a series of maps on individual resources prepared on clear acetate overlays,

thereby facilitating a visual comparison of systems which may be made by superimposing any or all of the maps. For purposes of reproduction, it was not possible to include acetate overlays with each document; however, the originals are available for inspection at the Council offices.

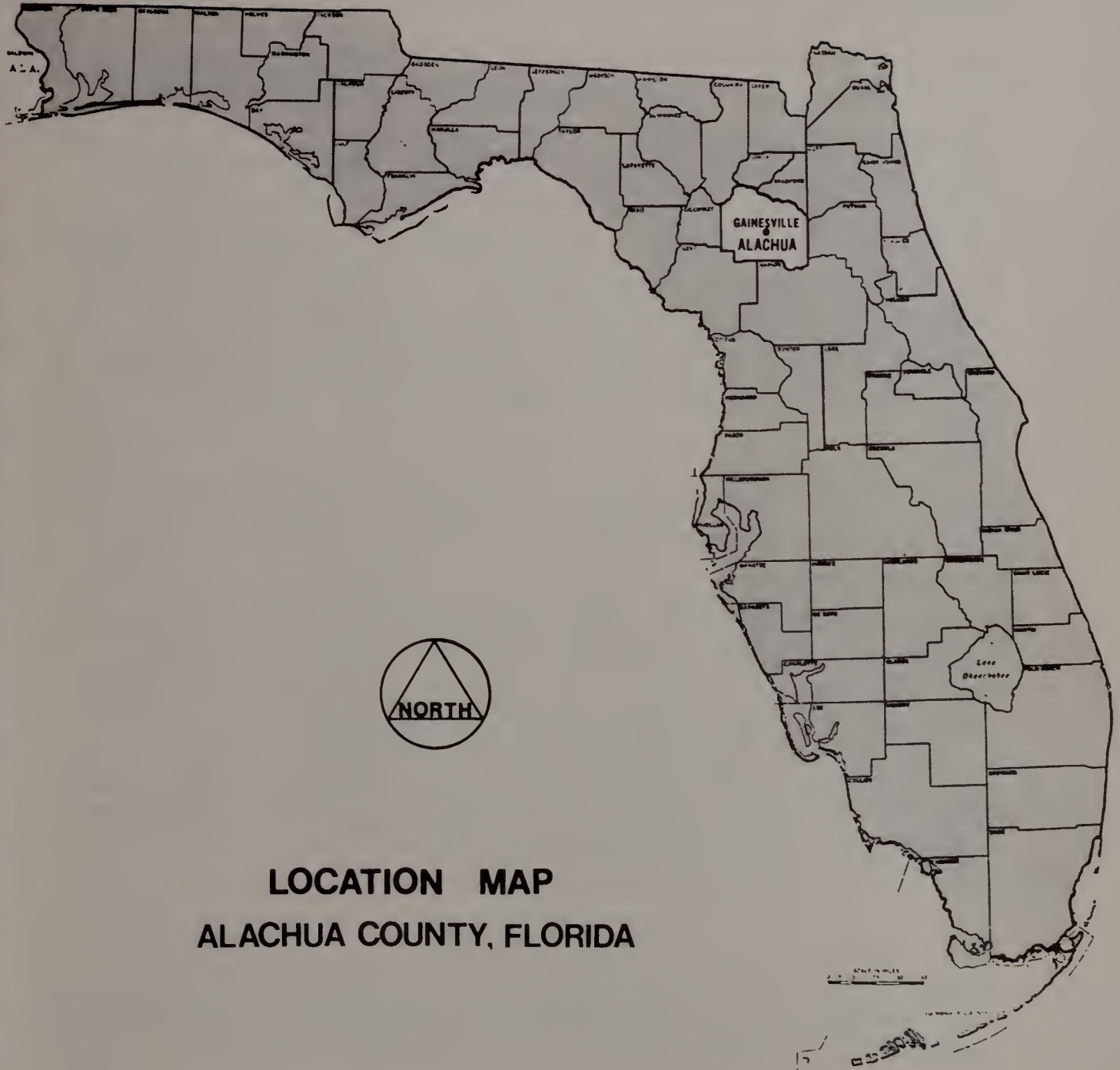
For purposes of comparison, each map utilizes up to six categories of increasing pattern density or intensity in which the lightest or clear sections represent areas having the least environmental sensitivity (or areas most suited for development) and the darkest patterns represent areas that are the most environmentally sensitive or have the highest relative natural values. These patterns only represent the relative sensitivity or suitability of each land use activity as it relates to that particular map theme. Because of the large number of possible interactions between elements of each map, no attempt was made to either assign quantitative values to each category or to adjust the pattern intensity on any map to reflect the relative importance or value of one resource to any other. Therefore, each map illustrates the relative position of each resource element only in respect to the particular resource mapped.

Despite the limitations imposed by the absence of quantitative data, the system of map overlays employed allows the comparison of a variety of resources and visually defines areas having significant limitations or suitability for growth. This comparison allows qualitative decisions to be made on general trends and intensities of land use projected for the County.

The maps themselves must be considered limited in detail and utilized only for general planning purposes. This is necessary not only because of the limitations imposed by map scale but because detailed information necessary for site evaluation was often not available at the time of writing. For example a modern soil survey for Alachua County is essential for specific site planning. Until the current survey is completed general soils map available for the county must be employed. General information for specific sites, therefore, may be drawn from the information contained herein and utilized as a general guide for obtaining more specific information in order to accurately ascertain any limitations which may exist.

This study represents a cooperative effort between the North Central Florida Regional Planning Council and the Department of Community Development of the City of Gainesville. Because the areas of concentration and concern differ, the reader is referred to that study prepared by the Department of Community Development entitled Environmentally Sensitive Areas-1975 which addresses, in more detail, those aspects of the environment and natural resources of particular concern to the Gainesville Urban Area.

Map No.1



GEOLOGY

Introduction

Beneath that relatively thin veneer of sediments lying at the earth's surface known collectively as soils, lies some 8,000 miles of rock strata. Modern man relies heavily upon those few rock formations lying at or near the earth's surface for many important resources essential for survival, growth and development. There are many facets which must be examined in a consideration of these resources. Not only do these rock formations provide the foundation upon which structures may be built but they often contain or are comprised of raw materials which may be useful for creating a wide variety of products.

The structural characteristics of underlying rock strata influence growth and development by providing a firm base upon which facilities may be constructed. Likewise their chemical composition and physical characteristics make them amenable to such uses as septic tank drain fields, aquifer recharge, etc. In terms of chemical constituents, rock formations often yield useful mineral products such as gypsum and clay as well as rock products including phosphates, limestone and marl. Many such geological products are found in Alachua County, some of which have been mined in the past and others which may be commercially valuable in the future.

This section contains a general description of the geology of Alachua County, its rock formations and subsurface structure. Also included are the more important associated rock and mineral deposits with an evaluation of their economic attributes. Much

of the discussion on the character of rock formations is summarized from a number of other publications which are noted in the bibliography. The reader is referred to those documents for more explicit discussion.

General Geology

In general, the rock formations lying within several hundred feet of the earth's surface may be described collectively as consolidated and semi-consolidated marine and non-marine deposits of sand, clay, marl, limestone and dolomite (a magnesium rich limestone). The individual rock formations discussed in succeeding paragraphs will further describe these relatively "shallow" deposits in the order of bottom to top, or in this case, oldest to youngest. However, it should be noted that all formations described are not continuous in the subsurface beneath the County. The areal extent of those formations exposed at the earth's surface is depicted on Map #2.

The Lake City limestone is the oldest formation from which supplies of fresh water are obtained. This formation is principally a dolomitic limestone which includes many beds of sulphur, fossiliferous limestone and seams of peat or lignite. The Lake City limestone approaches nearest the surface in southeastern Alachua County where it has been found lying approximately 150 feet below mean sea level. It is overlain in the subsurface by the Avon Park limestone, a dense to porous dolomite with a few beds of limestone and is nearest the surface in the southwestern portion of the County.

The limestone formations known collectively as the Ocala Group are usually considered as a unit because of their similarity

and are described as such in this report. The Ocala Group lies over the Avon Park limestone and is the oldest rock exposed at the surface within the County. The upper part of the Ocala Group is described as a soft coquina limestone with the lower portions consisting of hard and soft dolomitic limestone. The limestones of the Ocala Group have been mined for a number of years in the southern and western portions of the County where they are exposed at the surface. In this portion of the County a limestone plain has been formed which is characterized by solution features typical of Karst topography, i.e., sinkholes, caverns, prairies, etc.

The Ocala Group, Avon Park, and Lake City formations and sometimes the overlying beds of the Hawthorne formation are considered together as the Floridan aquifer because of their similar excellent porosity and permeability. The value of these formations for fresh water storage is described in the chapter entitled "Water Resources".

The Suwannee limestone has been found to overlie the Ocala Group in the northwestern portion of the County. Due to their similarity, it is often difficult to distinguish between the Suwannee and Ocala Group except by characteristic fossil elements. The Suwannee reaches a maximum thickness of 30 to 50 feet and is only recognized at the surface by exposures of boulders.

The Hawthorne formations overlie the Ocala Group and the Suwannee limestone and are exposed at the surface over much of northern and eastern Alachua County. The Hawthorne is a marine deposit consisting of thick beds of clay and sandy clay and containing beds of sandy phosphatic limestone. It reaches a

maximum thickness of 200 feet in the County and, because its composition usually forms a gentle rolling surface.

The Choctawhatchee formation lies beneath the surface in northeastern and eastern Alachua County and is exposed only in a few prairies or low areas where overlying sediments have been removed. Found in thicknesses of from 10 to 30 feet, the formation is comprised of a fossiliferous clay and marl with small amounts of phosphate pebbles.

The Alachua formation forms low rolling hills over the Ocala Group in the southwestern corner of the County. This formation is primarily a terrestrial sand deposit which is often found interbedded with phosphate pebbles and sandy clays. Thicknesses range from 25 to 35 feet. The phosphate occurrences in this formation are significant and will be further discussed in this chapter.

The youngest formation recognized in Alachua County, not including the thin layer of sands and soils which blanket the area, are the Pleistocene sand deposits. Several wave formed terraces consisting of marine sediments, which were deposited during the early glacial epoch when most of Florida was under water, comprise these older Pleistocene deposits. Consisting predominantly of unconsolidated sand with lesser amounts of clay, these sands vary from 20 to 45 feet thick over much of the eastern and central portions of the County.

Geologic Map Preparation

The general geology of the County as shown by Map #2 represents the approximate areal distribution of each rock formation that

would be exposed at the earths surface assuming the thin veneer of soil deposits were removed. For the purposes of this report it is necessary to assign relative values to each formation based on each element's suitability or sensitivity to a higher intensity of land use. The rating scheme is subjective in nature and is based upon a general evaluation of the overall limitation or sensitivity of each formation with regard to its value as a natural resource and/or its development potential.

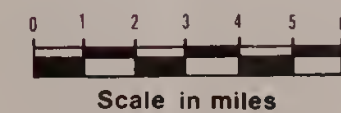
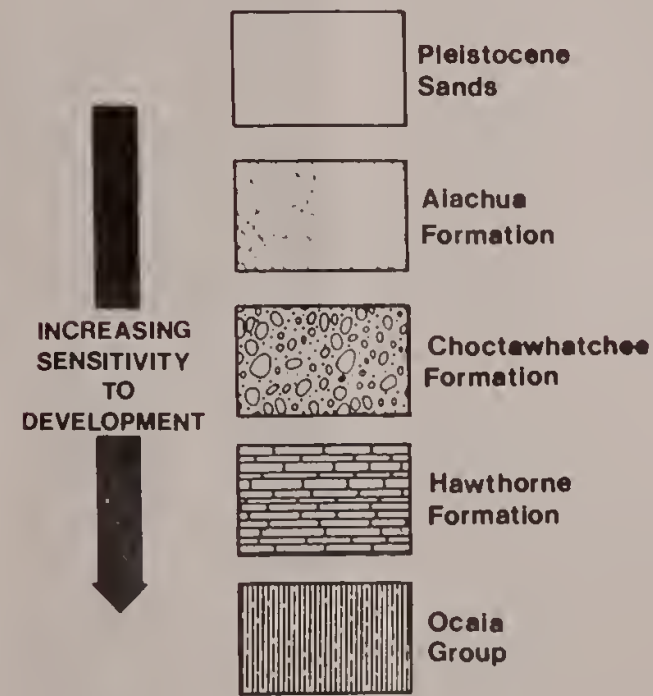
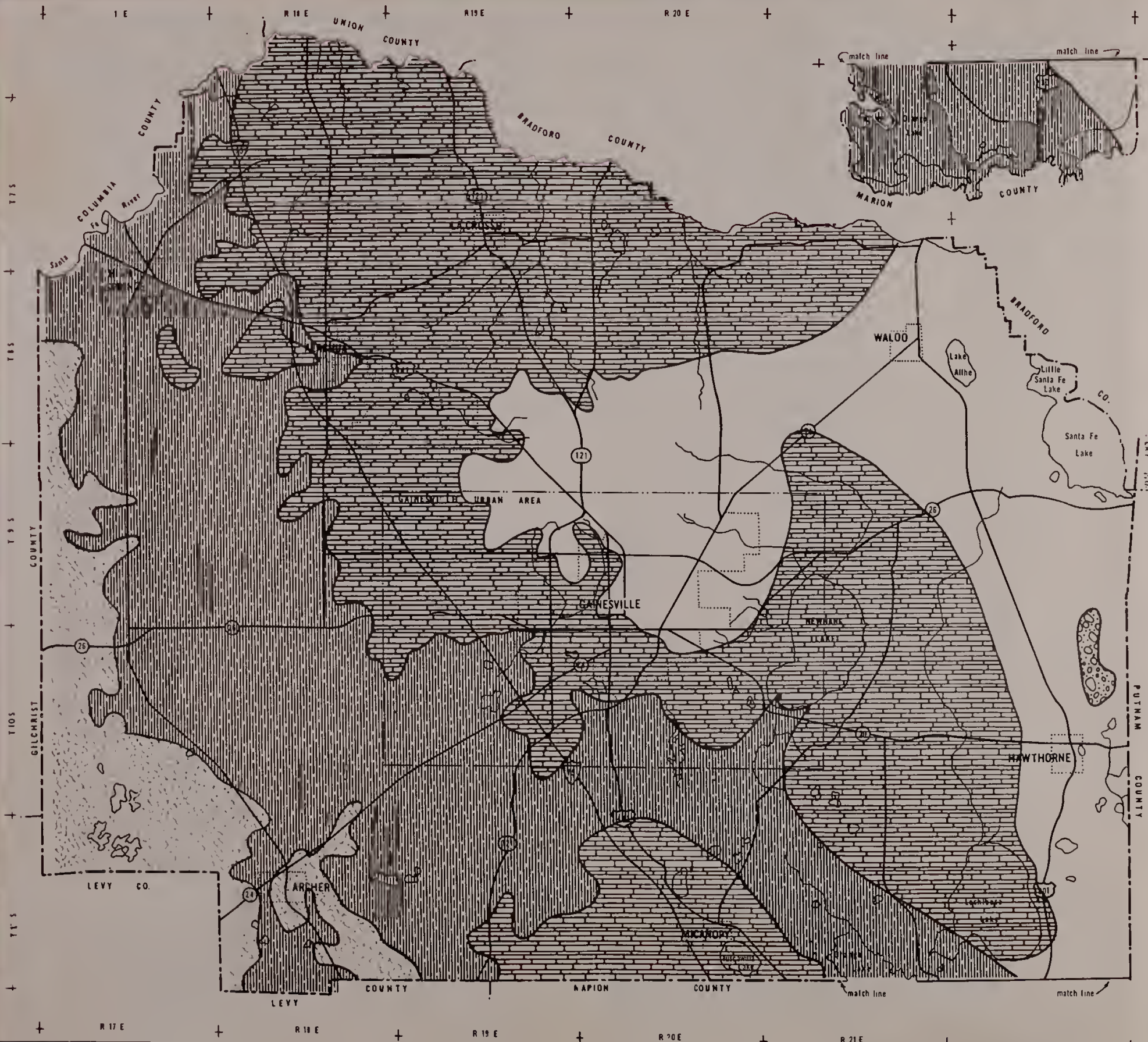
This determination was made basically as follows: Pleistocene sand deposits because of their generally good bearing capacity and excellent drainage capabilities are noted as having the least limitations or restrictions to intensive land use.

The Alachua formation, although primarily a sand and gravel deposit, is often interbedded with sand, clays and pebbles. Because of the clays which might hinder development and because of the possibility economic value of phosphate deposits, this formation was classified as having relatively slight limitations to development.

The Choctawhatchee formation was selected third because of its clayey nature, limited distribution, and location of exposures in the Stanley Prairie area of eastern Alachua County essentially confine its reported occurrence to wetlands.

The Hawthorne formation was placed fourth in order not only because of its wide areal extent, but because of its high water table and clayey nature have often proved it unsatisfactory for septic tanks and may otherwise impose limitations to intensive development.

Map No.2
GENERAL GEOLOGY
MAP
 FOR
ALACHUA COUNTY
 FLORIDA



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The limestone formations of the Ocala Group were assigned the highest degree of sensitivity of the five formations represented at the surface. This evaluation is based on the degree to which limestone at the surface may restrict construction, particularly underground utilities, on the value of the limestone as a natural resource, and most importantly on the potential afforded for pollution of the subsurface Floridan aquifer through this information.

The foregoing discussion does not imply that areas with relatively high limitations should be barred to all construction and development, but rather that in many cases a greater degree of consideration and possibly extensive investment in material and energy would need to be expended to preclude potential problems and hazards to, or afforded by, natural systems and problems caused by these systems. Depth of soil overburden above each formation and soil characteristics are only two examples of where other extenuating geological factors can affect growth and development.

Rock and Mineral Resources

Rock and mineral resources are special from a conservation point of view in that they are non-renewable resources, i.e., once high grade deposits are depleted it will require increasing amounts of money and energy to obtain or refine new raw materials from remaining supplies. Because of the tremendous demands placed on our mineral resources by our industrial system, many of our proven mineral reserves can last no more than a few decades. Even the huge phosphate reserves of south Florida are recognized to have very finite limits within this magnitude of time.

Inasmuch as our entire economy depends upon a balanced input from all resources it is apparent that potential limitations imposed by deteriorating reserves of high quality, non-renewable resources are a key consideration in planning for the future. Therefore, an understanding of their central role in maintaining our way of life is critical to comprehensive planning activities.

Certain rock and mineral deposits in Alachua County are noteworthy and significant as natural resources. The objective of this section is to describe their occurrence, potential for economic utilization and related development considerations. The deposits to be considered include limestone, phosphate, clay, sand, oil, and natural gas.

Clay Deposits

The State of Florida has been an active clay producer for many years. Until 1923, Florida produced more Fullers' earth type clay than any other state.

By 1922 as many as 23 different companies were operating in Florida. Since that time the number of working clay operations has decreased and in 1965 there were only two brick plants operating in Florida. However, the rapid increase in the population of Florida in the past decade has stimulated the building industry tremendously creating a market for additional materials. At the present time there are eight companies in Florida producing clay for a variety of products.

There are two basic types of clay which are important in Florida. Fullers' earth is a type of clay with little plasticity. Its properties as a natural active bleaching agent were utilized during the Middle Ages for removing grease and fat from woolen cloth, and later aided in refining of mineral and vegetable oils. In the modern day it is used to de-ink newsprint and as an additive to concrete, soaps, and insecticides, cosmetics, adhesives, ceramic glazes and many more products. Koalin is another clay product important to Florida. Koalin is a high grade clay often called China clay. It has many uses in addition to the manufacturing of china and pottery. Its largest use is as a filler in paper, but it is also used in the rubber industry and in the manufacture of refractories.

Clay is one of the common products of the decomposition of rocks. It is usually made up of a number of different minerals in varying proportions and is often defined as a very fine grain, earthy material which becomes plastic (workable) when wet.

Of importance to Florida are the clays utilized for common brick manufacture. These clays are usually of an impure, often sandy composition, have a medium degree of plasticity and vary in strength, color and other properties. These clays are widely distributed in Florida and appear to be the most common variety of clay found in Alachua County.

O.G. Bell (1923) reports that clays in Alachua County are widespread but are usually of a sandy nature which in addition to other impurities often precludes their usefulness. Among the types of clay he describes are residual clay deposits attributed to the decomposition of the Ocala Group of limestones.

He reports these to be abundant in the eastern portion of the County and a number of deposits have been found to be suitable for the manufacture of common brick. Bell noted that at the time of writing in 1923 that this material was being mined and utilized in brick manufacture by the Campville Brick Company formerly located 1/2 mile north of Campville and that other similar operations were also being conducted elsewhere in the County. That author also cited the occurrence of many small but similar deposits of clays associated with the phosphate deposits of the Alachua formation of southwestern Alachua County.

Bay and Munyan (1935) describe the presence of limited deposits of Fullers' earth type clay in several small areas of the County. These areas include one about one mile north of Micanopy on U.S. 41, as well as in the Devil's Millhopper and Alachua Sink. No evidence has been found in the literature to suggest that Fullers' earth deposits have been mined in the County.

Apparently the quality and quantity of clay deposits in the County was not sufficient to warrant continued operations and at the present time no commercial use is made of this resource.

Except for reports dealing with special type clays, little information was compiled for Alachua County from 1934 until 1964 when the Florida Geological Survey conducted a brief ceramic clay investigation for Alachua, Clay and Putnam Counties. In this study, preliminary work was done in the eastern part of Alachua County utilizing hand auger sampling and examination of cuts in old abandoned clay pits. All exposures found were reported to contain an excessive percentage of quartz sand.

This additional exploration was confined to the right-of-way of State Highway 26 west of Gainesville. These examinations extended approximately four and one-half miles west of I-75.

In this area, clay thicknesses varied from two to twenty feet under overburden ranging from zero to twenty feet thick. As reported, only one hole displayed commercial potential, while the other samples contained an excessive amount of quartz sand.

In general then, although Florida's Fullers' earth production was second highest in the nation in 1972, none of this material was produced in Alachua County. However, because of the extent of the various clay deposits in the County there may be future potential for clay production contingent upon further exploration and refinement of methods to wash impurities from clays as they are removed from the earth.

Limestone Resources

The Ocala Group of limestones lends itself to mining because of its location at or near the land surface in western Alachua County. The topmost formation of that group has been differentiated as the Crystal River formation and can generally be described as a "soft, white to cream colored, chalky, coquina limestone" grading toward downward into alternating layers of "tan to brown, crystalline limestone and dolomitic limestone".

Because of its varying composition, this limestone is not suitable for building stone but is suitable for use in construction as crushed rock. The major limiting factor to limestone mining and utilization is the availability of inexpensive transportation.

Therefore, the product is usually mined near adequate roads or railway transportation to be economically competitive. Quarries in the western part of the County must concentrate along or near transportation routes for this reason.

According to the Bureau of Mine's Minerals Yearbook, 1972, Alachua County has four quarries supplying crushed limestone and dolomite. Production in 1971 totaled 2,035,040 short tons for a value of \$1,596,000 and in 1972 production totaled 2,166,000 short tons for a value of \$1,741,000. This represents only about 4.3% of the State's total production by volume in 1972.

Because of the large volume of naturally available limestone, Alachua County will probably continue to produce crushed limestone and dolomite for some years. As with abandoned phosphate mines, limestone quarries are not easily reclaimed and become both a nuisance and liability to owners. Reclamation is often possible to a limited extent by such measures as filling with non-putrescible waste, such as construction debris, or conversion of sites into managed recreational areas.

Because of the nature and proliferation of limestone quarries, there are no simple remedial actions which can be taken to reduce their detrimental aspects. Therefore, their management and reclamation through the currently proposed Alachua County Surface Mining and Land Reclamation Ordinance is appropriate and necessary for maintaining the environmental quality of such sites in the County.

Sand

As evidenced by the preceding section on geology, sand is one of the most abundant surface materials in the County. Although many areas have been mined in the past and new sites are utilized as demand requires, this sand remains a common variety, useful as fill material or to suit other general requirements. No specialty sands, such as those having consistent color, composition or grade size, used for glass manufacture and similar products requiring a high grade material, have been found within the County. Sand deposits in Alachua County are therefore useful for general purposes but apparently not significant in terms of economic potential.

Oil and Gas Resources

It appears that there has almost always been an interest in the possibility of producing oil and gas in Florida. Since the establishment of the Florida Geological Survey in 1907, attempts have been made to record details of all exploratory drilling and to gather historical data on previous explorations wherever possible. In June, 1945, the Florida Legislature enacted a law regulating the drilling of oil and gas. The law required that information collected be kept on file with the Florida Geological Survey. This promoted more accurate data acquisition as well as the creation of a filing system to be used for future reference and utilization in exploration surveys.

Wells drilled prior to 1939 were based largely on general geologic evidence or hunches, such as topographic and physiographic resemblance to oil fields located in other areas.

From 1940 to the present the exploration of oil and gas has been rather extensively conducted by the major oil companies. Although wells have been drilled all over Florida, including a number in Alachua County, no more than traces of oil were ever found in this County.

During 1972, nine oil fields were producing in Florida. Six of these are located in the Sunnyland limestone of Collier, Hendry and Lee Counties. The other three are located in Santa Rosa County. At the present time, although explorations are continually being carried out in this State, there appears to be little evidence to suggest that oil or gas reserves will be found beneath Alachua County.

Phosphate Resources

Phosphate deposits of northern Florida consist primarily of marine phosphatic sedimentary rocks made up of clays, sand, dolomite and a variety of alterations of this material formed by weathering processes. The phosphate-bearing rocks and minerals of Florida have been classified into four very general categories: land pebble, river pebble, hard rock and soft rock. Of these, only the land pebble, or granular phosphate, is being mined in Florida. River pebble or stream placer deposits are relatively unimportant in this area and "soft rock" deposits (clayey sands with phosphate particles) are normally associated with hard rock deposits and are not differentiated in this discussion. Due to differences in occurrence and composition, the two categories, hard rock phosphates and pebble phosphates, are considered individually.

Hard Rock Phosphate Deposits

Hard rock phosphate was apparently first identified in Florida and utilized on a local scale in Hawthorne in 1883 after it was discovered that sandstone being quarried locally contained considerable amounts of phosphate. In 1888, phosphate was discovered in what is now part of the hard rock phosphate district near Dunnellon in Marion County. Following the discovery of these extensive hard rock phosphate deposits in Marion County, commercial mining developed rapidly until 1907 when the production of hard rock phosphate in north central Florida reached a peak. At that time, there were 45 companies producing hard rock phosphate in central and north central Florida. By 1909, there were only 20 companies operating in 74 locations, 22 of which were in Alachua County. The hard rock field was generally closed during World War I except for limited output by one company. After the war, production was again resumed on a scaled down basis and declined until 1966, when all hard rock phosphate production in Florida ceased.

The hard rock phosphate deposits of Florida are roughly confined to a north to south trending linear belt along the west side of the peninsula. This concentration is largely controlled by the Ocala Uplift. The Ocala Uplift is an elongated anticlinal fold or arch stretching some 200 miles long and 70 miles wide. The axis lies a few miles west of Alachua County. The hard rock phosphate concentration occurs principally along the central portion of this uplift in an area 100 miles long and 30 miles wide covering a total area of some 1,500 square miles. These hard rock deposits are found in 15 counties including Alachua, Columbia, Gilchrist, Levy and Suwannee in this region.

The deposits are highly irregular in shape and size and range from several feet to over 100 feet in thickness. In the Newberry area of western Alachua County the maximum thickness is about 50 feet and the average less than 30 feet. It is reported that gray, phosphatic, clayey sand, as much as 80 feet thick, covers most hard rock deposits. However, it is noticeably absent in some areas particularly between Newberry and High Springs where much of this cover material has been eroded away.

The geology of the hard rock deposits is very complex. These deposits have been described as irregular mixtures of quartz, sand, chert, clay mineral and carbonate fluorapatite, principally in the form of collophane ($\text{Ca}_5\text{F}(\text{PO}_4)_3$), an amorphous, phosphate-rich mineral. Most investigators agree that, in general, hard rock phosphate deposits correspond to the Alachua formation described in earlier sections of this report. Therefore, hard rock deposits as indicated in Map #3 are represented as conforming to the areal extent of the Alachua formation in southwestern Alachua County.

In the 1890's and early 1900's hard rock phosphate production flourished because, with naturally occurring high phosphate percentages, it was ideal for export as washed and screened rock. As beneficiation techniques were improved for the much larger deposits of land pebble phosphate, hard rock production declined.

Renewed activity in hard rock phosphate deposits depends upon several factors which include:

- 1) Depletion of present premium grades (74% BPL¹ and above) and quantities of land pebble deposits.
- 2) Reduced transportation costs.
- 3) Minimum competition from other sources of phosphates.

In summary, one area between Newberry and High Springs is considered to have excellent prospecting potential. Should such factors as outlined above become satisfied, prospecting will become necessary to accurately assess the distribution, volume and quantity of hard rock deposits before their economic potential can be fully appreciated. However, such potential is not readily foreseeable.

Land Pebble Phosphate Deposits

Most of the phosphate produced in Florida comes from the Bone Valley Field in Polk and Hillsborough Counties. These rich phosphorite (phosphatic, clayey sand) beds of south Florida are termed "land pebble" phosphate deposits. This term has also been applied to the rich phosphate beds of the Hawthorne formation of Florida.

In Alachua County, pebbles and grains of phosphate minerals occur throughout the sediments of the Hawthorne formation and also occur as concentrations in lenses or other irregular bodies. Pirkle (1957) reported on important occurrences of pebble phosphate in the upper part of the Hawthorne formation in Alachua County. This zone of phosphatic materials varies in thickness from a few feet to 30 or 40 feet and consists largely of pebbles and grains of phosphate embedded with varying combinations of sand, clay and carbonate materials.

¹1.0 percent BPL (Bone Phosphate of Lime or tricalcium phosphate) equals 0.458 percent P_2O_5 , or BPL equals P_2O_5 times 2.185.

These sediments are covered by sand and clay sands up to 45 feet thick.

Two areas of heavy concentrations have been indentified by Pirkle (1957). The first occurs in an area of approximately 50 square miles in the plateau area just north and northeast of Gainesville and the second south of State Road 20 between the towns of Grove Park and Hawthorne. In addition, that investigator reports that pebble phosphates underlie extensive areas of the County. This tends to support Mansfield's (1942) outline of a more extensive distribution of pebble phosphates in eastern Alachua County as shown on Map #3 and suggests the need for more extensive exploration to more accurately assess the areal extent of the land pebble deposits.

The grade of phosphates sampled by investigators in core drillings ranges from 62.5% of 65.4% BPL. Pirkle (1954) estimated that phosphate reserves in Alachua County consist of a minimum of 30 to 50 million tons of recoverable phosphate whose grade will exceed 50% BPL. At the time of writing, it was indicated that the land pebble phosphate deposits in the County were not of sufficiently high grade to be mined. However, information is available indicating that at least one company intends to mine similar pebble phosphate deposits in the near future in Bradford County suggesting that there exists a real potential for future mining in Alachua County.

In any event, phosphate producers must eventually mine lower grade material because it is a non-renewable resource, and although there is a great quantity of low grade phosphate in the Bone Valley District there is also a tremendous potential for the development of additional phosphate deposits in areas of north central Florida. Pebble phosphate is also known in Hamilton, Bradford, Clay and other counties.

In summary, pebble phosphates at the top of the Hawthorne formation in the plateau area of Alachua County do add significant amounts to the low grade phosphate reserves of Florida and cannot be overlooked. Therefore, the potential for economic development of phosphate reserves in the future, particularly in light of rising population and increased demand for food production, is a reality which must be considered by local planners.

Inasmuch as phosphate is obtained by strip mining techniques, land reclamation and management techniques will play an increasingly important part in the environmental control aspects of mining regulations. Therefore, local governments and planning agencies will be called on to assess the compatibility of phosphate mining with growth and land development in north central Florida.

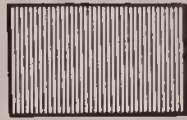
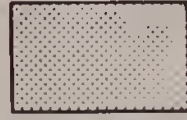
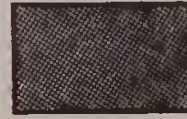
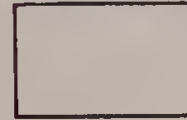
Evidence of the impacts caused by past phosphate mines in Alachua County are still evident in the western portions of the County. Some of these areas are owned by farmers, and others by corporations. Many consider the abandoned mines a visual liability. It is reported that some of these areas could be converted to valuable recreational sites. Many mined facilities in future years may be directed, through the proposed Alachua County Surface Mining and Land Reclamation Ordinance, to preserve the environmental integrity of such areas for the benefit of future users and thereby enhance the environmental state of the County.

Rock and Mineral Resources Map Preparation

The resources map noted as Map #3 in the text is included to illustrate the general distribution of rock and mineral resources in the County. However, because of its general nature and the difficulty involved in making qualitative evaluations necessary to justify relative values based upon economic potential this map is not used as an overlay in developing the composite map of natural resources.

Map No. 3 GENERAL ROCK AND MINERAL RESOURCES MAP FOR ALACHUA COUNTY

FLORIDA

-  Pebble Phosphate District
-  Known Land Pebble Phosphate
-  Limestone District
-  Limestone Quarries
-  Hardrock Phosphate District

+ Hardrock Mines

S Sandpit



Scale in miles



WATER RESOURCES

Introduction

Although the basic amount of water in Florida remains relatively unchanged, population growth and urban and industrial development continue to put increasing demands on the available supply. Serious water shortages in terms of the entire state appear unlikely, however, it is certain that in future years water will not be available in sufficient quantities in each basin or hydrologic area to fully meet the potential demands that will be placed on this resource. Therefore an analysis of this resource has become a vital function of natural resource planning.

Water is a renewable resource, or more accurately, a recyclable resource. It is neither created nor destroyed through its use its movement through the hydrologic cycle, but rather only its character and location are changed. The hydrologic problem then, is fundamentally one of water accounting so that a balance of water quality and quantity may be maintained in natural systems.

Surface Water Resources

From Map #4 it may be seen that Alachua County is divided between two major drainage basins. The southeast portion of the county lies in the St. Johns River Basin. Drainage travels through the smaller Orange Creek Basin in the County and ultimately through the St. Johns River to the Atlantic Ocean. To the north and northwest the Santa Fe River Basin is part of the larger drainage system known as the Suwannee River Basin which ultimately drains to the Gulf of Mexico.

Santa Fe River Basin

The Santa Fe River forms the entire northern boundary of Alachua County and drains an area extending three to fifteen miles south of the river. The Santa Fe River Basin which covers about 1,440 square miles has its headwaters in Santa Fe Lake in northeastern Alachua County. Twenty-two percent of this basin, or about 300 square miles, is in Alachua County. The hydrology of this basin is very complex. The upper reaches of the river have flow characteristics showing complete dependence on surface waters. However, downstream of Oleno State Park numerous springs feed the river from porous limestones at or near the surface indicating a close interrelationship between ground and surface water sources.

Orange Creek Basin

The Orange Creek drainage basin is only a small part of the much larger St. Johns River Basin. It drains through the Oklawaha River into the St. Johns River then to the Atlantic Ocean. The upper two-thirds of the Orange Creek Basin, approximately 340 square miles, is located within Alachua County. In Alachua County, Hatchet and Little Hatchet Creeks form the headwaters of this basin.

Lakes

There are a total of 119 lakes in Alachua County. The 44 named lakes have a combined area of 45,711 acres and the 75 unnamed lakes represent 3,243 acres for a total lake surface area of approximately 76.4 square miles. Although lakes are important for recreational activities in the County, they are unimportant as sources of public water supply. A

tabulation of the names and locations of all lakes may be found in the Water and Sewer Development Plan for Alachua County.

It is apparent from Map #4 that the lakes of Alachua County are not uniformly distributed. The majority of the lakes are situated in the eastern half of the county with the four major lakes located in the eastern third.

The number and diversity of lakes in Alachua County offer abundant opportunities for fishing, boating and various water contact sports to many residents and out of state visitors throughout the year. Therefore, the conservation of this fresh water resource is important to the economy as well as to the quality of life in the County.

Surface Water Quality

All waters in Alachua County have been classified as Class III - Recreation - Propagation and Management of Fish and Wildlife by the Florida Department of Environmental Regulation. As indicated by the classification, water uses affecting any of the surface water bodies in Alachua County must not impair the functions of the water body beyond limitations required for that classification. The requirements for Class III waters are reproduced from Chapter 17-3 of the Rules of the Department of Environmental Regulation in Appendix 1.

Because of their exposure to climatic changes and other natural systems, surface waters generally tend to vary in quality more than ground waters. In general, surface waters tend to be softer, i.e., contain fewer elements which

contribute to hardness. In addition, other parameters vary considerably, such as temperature which varies with season, depth and flow characteristics of the water body, pH which varies with organic content, dissolved oxygen, iron, and sulphates, and aquatic life forms. Some ranges of average stream chemical characteristics are noted in Table 1 below.

TABLE 1
AVERAGE RANGE OF SELECTED CHEMICAL CHARACTERISTICS
OF STREAMS IN ALACHUA COUNTY

<u>Parameter</u>	<u>Range</u>
Temperature	69° to 76° F
Iron	.23 to 1.9 mg/l
Calcium	3.3 to 7.4 mg/l
Magnesium	1.0 to 2.8 mg/l
Sodium	5.1 to 6.5 mg/l
Potassium	0.0 to 1.5 mg/l
Bicarbonate	4 to 100 mg/l
Sulphate	1.5 to 36 mg/l
Chloride	7.1 to 12 mg/l
Carbonate Hardness	16 to 30 mg/l
pH	5.4 to 7.2
Color	80 to 275 JTU

Source: Adapted from Report of Investigations #35, Florida Bureau of Geology, p. 78-87.

From the preceding chart it appears that color is the most objectionable characteristic of streams in Alachua County. High color is also common to many lakes where decaying organic material occurs in appreciable quantities within or adjacent to the water body. Iron content may be another objectionable characteristic because it often contributes to the taste and color of surface waters. Other chemical characteristics vary considerably and depend upon a variety of stream conditions. In summary, however, with the exception of incidences of pollution in streams, surface water quality in the County is generally good.

Although water quality in lakes of Alachua County would generally fall within the chemical parameters outlined for streams, because of their limited circulation, depth and other physical attributes, the lakes are more susceptible to other natural processes which make them more vulnerable to deterioration and slower to recover than flowing water bodies. The following discussion summarizes some of the more important aspects of lake water quality.

Eutrophication

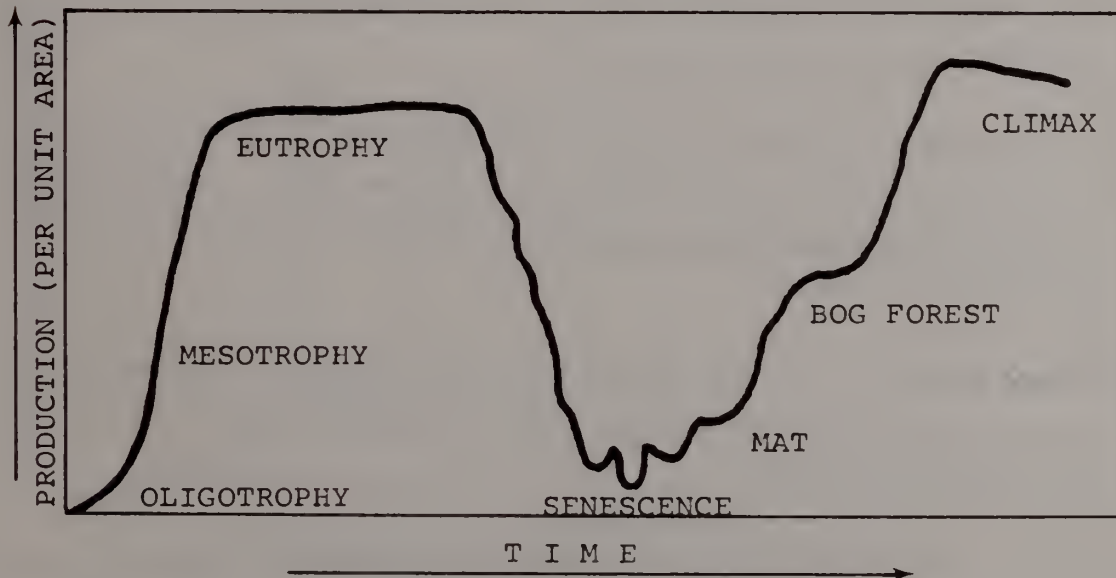
Over the course of many years, it is normal for lakes to become gradually enriched with nutrients through natural processes then, subsequently, through stages of deteriorating quality, gradually to fill in to become swamps and eventually dry land. In recent years increased urbanization and intense agricultural land uses have tremendously increased nutrient loads to lakes. This enrichment has accelerated the "aging" of surface water bodies, thereby shortening the lives of lakes and generally impairing water quality. Due to the mild climate in Florida, surface waters, especially

lakes, are particularly susceptible to the effects of a more intensive use of the land and accelerated aging processes.

This process of natural deterioration or aging of lakes is known as eutrophication and generally involves the response of a lake to nutrient enrichment. This response is reflected by a lake's trophic state (eutrophic condition) which is defined by a variety of physical, chemical and biological parameters.

The process by which a lake becomes enriched in nutrients and subsequently passes through stages of deteriorating water quality is shown in Figure 1 where trophic states are indicated as a function of time and vegetative production.

FIGURE 1
MODEL OF LAKE TROPHIC SUCCESSION AND EXTINCTION



Source: Shannon, 1975.

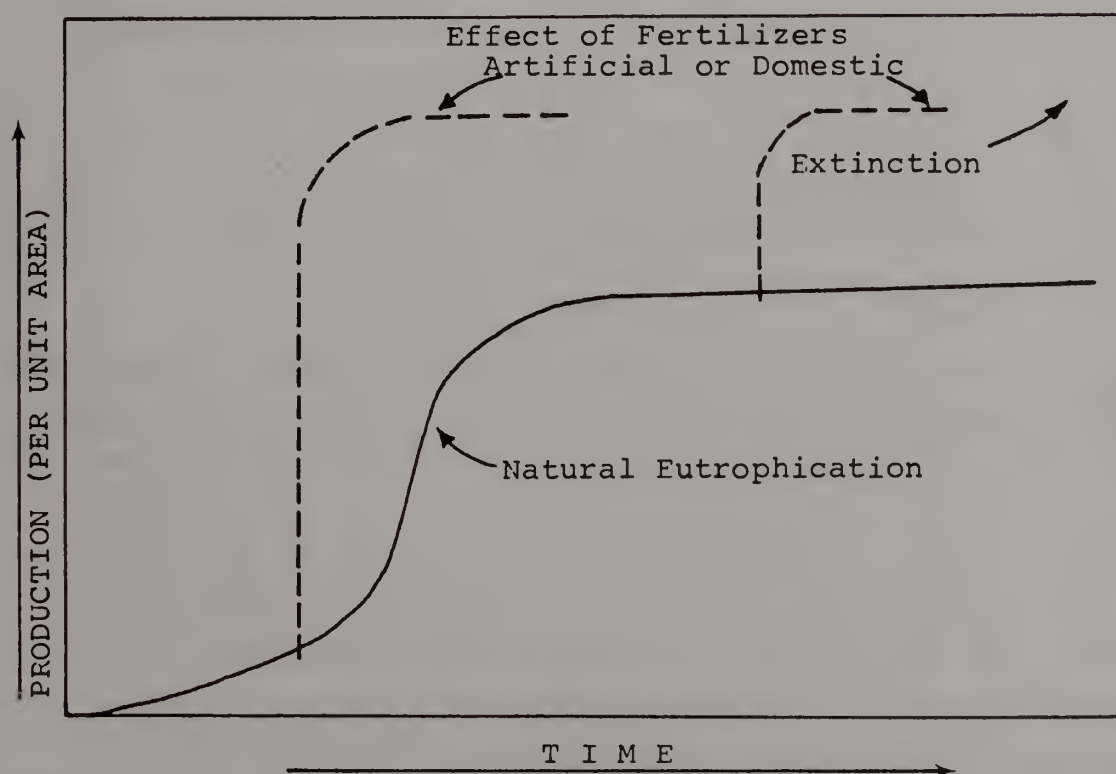
There are several terms which define trophic stages or lake conditions. These are defined in general terms as follows:

- 1) Oligotrophic: The youngest period or first stage in the life of a lake characterized by generally high water quality, good clarity, low concentration of plant nutrients and a small but diverse faunal population.
- 2) Mesotrophic: An intermediate lake stage lying between oligotrophic and eutrophic and defined by increasing nutrient levels and biological productivity.
- 3) Eutrophic: The third stage in the deterioration process after mesotrophic, typified by a water body rich in nutrients, large quantities of algae and aquatic weed species, low water transparency and large organic deposits.
- 4) Hypereutrophic: A lake condition in which aquatic productivity is at its highest levels, containing highest nutrient levels, and increasing amounts of sedimentation.
- 5) Senescent: Refers to the last stage of a lake prior to its total loss of identity as a water body. Sedimentation nearly complete, a generally high oxygen deficit and weed choked.
- 6) Dystrophic: A lake exhibiting high organic (brownish) color with much dissolved humic matter. Does not relate to trophic state.

Figure 1 illustrates the relationship between biological productivity and the relative age of a lake. It may be seen that during the initial life stages of the lake (oligotrophic and

and mesotrophic stages) there is only a gradual increase in productivity. As the lake enters the eutrophic stage the rate of biological productivity increases tremendously in a short period of time. Of special concern is the lake's relatively rapid change toward senescence and eventual extinction upon the addition of artificial nutrients as illustrated in Figure 2. This then is the essence of the problem associated with "cultural" pollutants. And because fresh water is vital to the total environment as well as to the provision of recreational and asthetic benefits, lake trophic status is significant to the total quality of life.

FIGURE 2
HYPOTHETICAL CURVE OF LAKE EUTROPHICATION



Source: Shannon, 1975.

Table 2 summarizes the location and basic trophic state of 33 of the larger lakes in Alachua County. Lakes noted are numbered on Map #4.

As evident from Table 2, Santa Fe Lake, Little Santa Fe Lake and Lake Altho represent the few oligotrophic lakes in Alachua County. Of particular concern are those lakes classed as either eutrophic or senescent. Newnans, Orange and Lochloosa Lakes, all in the Orange Creek Drainage Basin, show considerable evidence of eutrophication and are significant in that they represent not only the largest lakes in Alachua County but also those which have some of the greatest recreational and wildlife values. Because of the importance of these lakes to the overall quality of life in Alachua County, including not only their economic and recreation potential but also their value as wildlife habitats and esthetic open spaces, all perform an important function to those living or visiting Alachua County. Therefore, conservation of these water resources is essential if they are to remain in a useful condition.

It has been shown that in many cases the process of eutrophication may be reduced, arrested and possibly even reversed with adequate management techniques. In instances where the deterioration of a lake is considered to be a significant loss, a number of state and local agencies can be directed to devise, through cooperative planning, a program to fully assess the quality and character of the water body. Recommendations could then be made to deal specifically with remedial actions to retard lake deterioration. An ongoing program for collecting data on the trophic state of lakes in Alachua County, such as that of the Alachua County Pollution Control Board, should be encouraged. Such information coupled with

TABLE 2

TROPIC STATE OF
LAKES IN ALAHCUA COUNTY

Number	Name	Location	Depth (in meters)	Area (Acres)	Type
Santa Fe Basin					
1	Santa Fe	North of Melrose	8.5	713	OC
2	Little Santa Fe	North of lake (1)	6.5	188	OC
3	Hickory Pond	West of lake (2)	4	13	OC
4	Altho	East of Waldo	4.5	92	OC
5	Cooter Pond	North central part of county	3	50	M
Orange Creek Basin					
6	Elizabeth	Southwest of Melrose	2.5	23	MC
7	Clearwater	Southeast of Melrose	3		O
8	Hawthorne	Hawthorne	3.5	14	EC
9	Little Orange	SF of Hawthorne	3	98	MC
10	Unnamed	South of lake (9)	4	20	MC
11	Moss Lee	SE of lake (10)		23	
12	Jeggord	South of Hawthorne	4	34	D-MC
13	Still Pond	East of Lochloosa			
14	Lochloosa	SE part of county	3	1006	F
15	Orange	SE part of county	3	1258	F
16	Palatka	South of Newnans Lake	1	10	D-S
17	Newnan's	East of Gainesville	2	1038	HEC
18	Mize	NE of Gainesville	22	.4	D-OC
19	Trout	SF of Gainesville	1.5	6	D-EC
No Surface Drainage Region					
20	Meta	NW of Gainesville	1.5	2	M
21	Unnamed	South of Gainesville	3	.7	E
22	Bivens Arm	South Gainesville	2	28	HE
23	Alice	U. of F. Campus	2	15	S
24	Clear	SW Gainesville	2	2	EC
25	Unnamed	West of Gainesville	2	3	M

TABLE 2 continued

Number	Name	Location	Depth ¹ (in meters)	Area (Acres)	Type ²
26	Unnamed	South of lake (27)	-	1	D-MC
27	Unnamed	NW of Gainesville	5	2	M
28	Kanapaha	SW of Gainesville	1	34	E-S
29	Watermelon Pond	SW part of county	2	256	D-OC
30	Long Pond	West of Micanopy	1.5		D-OC
31	Burnt Pond	West of Lake Wauberg	2.5	9	EC
32	Wauberg	NW of Micanopy	5	42	E
33	Tuscawilla	South of Micanopy	2	26	MC

Lake Type: O = oligotrophic

M = mesotrophic

E = eutrophic

HE = hypereutrophic

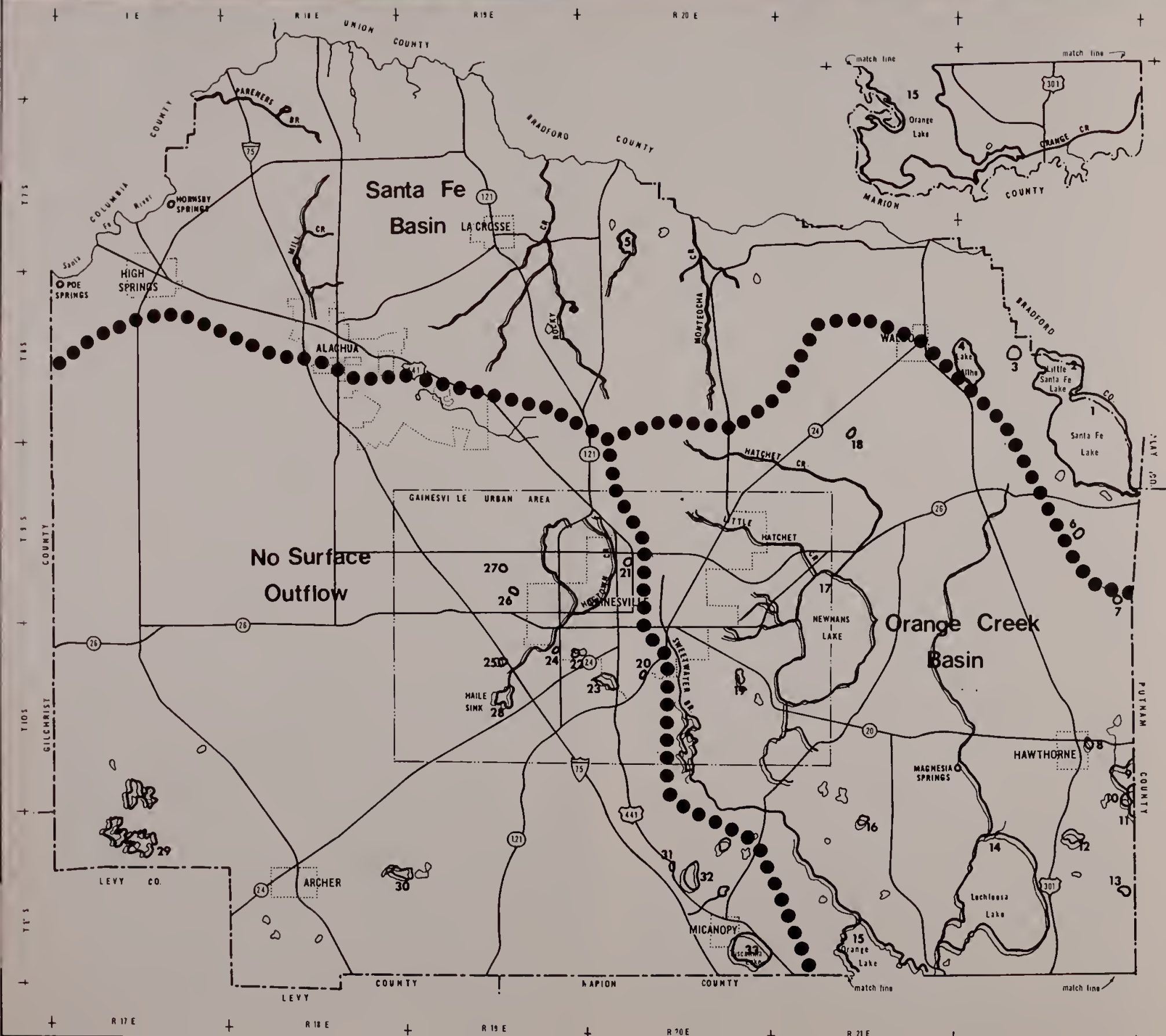
S = senescent

D = dystrophic

C = high organic color in water

Source: Brezonik, et al, 1969.

Map No.4
**SURFACE WATER
 RESOURCES MAP**
 FOR
ALACHUA COUNTY
 FLORIDA



●●●●●●● Basin Divide

(See Table 2 For Lake Names
 and Character)



Scale in miles

TABLE 2 continued

Number	Name	Location	Depth ¹	Area	Type ²
--------	------	----------	--------------------	------	-------------------

reports prepared by other agencies could be incorporated into general planning activities providing for the overall development and conservation of the County's surface water resources.

Groundwater Resources

Groundwater is probably the single most important natural resource available to the citizens of Alachua County. Although its highest function is as a source of potable water, it also serves to maintain water levels in lakes and streams. Where groundwater discharges at ground surface through springs, recreational sites also become possible.

Potable water supplies come from two major sources: the Floridan aquifer and what may be termed the upper or secondary aquifers. The upper aquifers are those water containing rock or sand formations lying physically above the limestones of the Floridan aquifer. These aquifers usually consist of a water table aquifer found close to land surface in surficial sand or soil deposits and other secondary aquifers often found in thin layers of limestone or other porous material lying between the water table aquifer and the Floridan aquifer below.

The water table aquifer is usually comprised of sands of the Pleistocene terrace deposits and the sand and limestone layers at the top of the Hawthorne formation. The water table aquifer is absent in a 300 square mile area in southwestern Alachua County where the limestones of the Floridan aquifer are very close to the surface.

Secondary aquifers are often artesian, i.e., the water within is under pressure and sometimes flows through wells at land

surface. They occur principally in the limestone or sand layers in the lower part of the Hawthorne formation and, in northeastern Alachua County, in the Choctawatchee formation. Probably more wells in Alachua County tap the secondary artesian aquifers for potable water supplies than any other source. However, in most areas of Alachua County, neither the water table aquifer nor the secondary aquifers yield sufficient water for large supplies.

The Ocala Group of limestones and possibly the lower portion of the Hawthorne formation make up the Floridan aquifer throughout the region. It is one of the most productive and extensive groundwater bearing formations in the United States and easily transmits and stores more water than any other aquifer in north central Florida. In the western and southwestern portions of Alachua County where there is no confining layer, the aquifer is under water table conditions. In the rest of the County the Floridan aquifer is under artesian conditions and will flow through a well at the earth's surface if the artesian or piezometric pressure level exceeds the ground surface elevation. The Floridan aquifer is recharged by waters slowly flowing down through overlying and confining beds of the Hawthorne formation or by percolating directly into the aquifer where no confining beds are present such as in southwestern Alachua County. Although the entire County is considered to be an area of recharge, of special interest are areas of sinkhole occurrence in the County such as Haile Sink at the base of Hogtown Creek and Alachua Sink in Paynes Prairie. The 400 square mile area in the southwestern portion of the County is an area where the highest recharge occurs because of the general absence of significant overlying material.

Because of the importance of this resource the recharge capabilities of the County must be considered during the land use planning process to ensure the compatibility of future land uses with recharge potential. From Map #5 it may be observed that the highest recharge in the County occurs in areas where the Ocala limestones are nearest the surface and in sinkholes discharging directly into the Floridan aquifer. Areas with poorest recharge potential correspond to the areal extent of the Hawthorne formation which because of its clayey nature almost precludes the flow of water down to the aquifer. Intermediate recharge potential is exhibited in those areas having only a thin layer of permeable overburden over the Ocala limestones such as that area covered by sands of the Alachua formation.

Water Budget

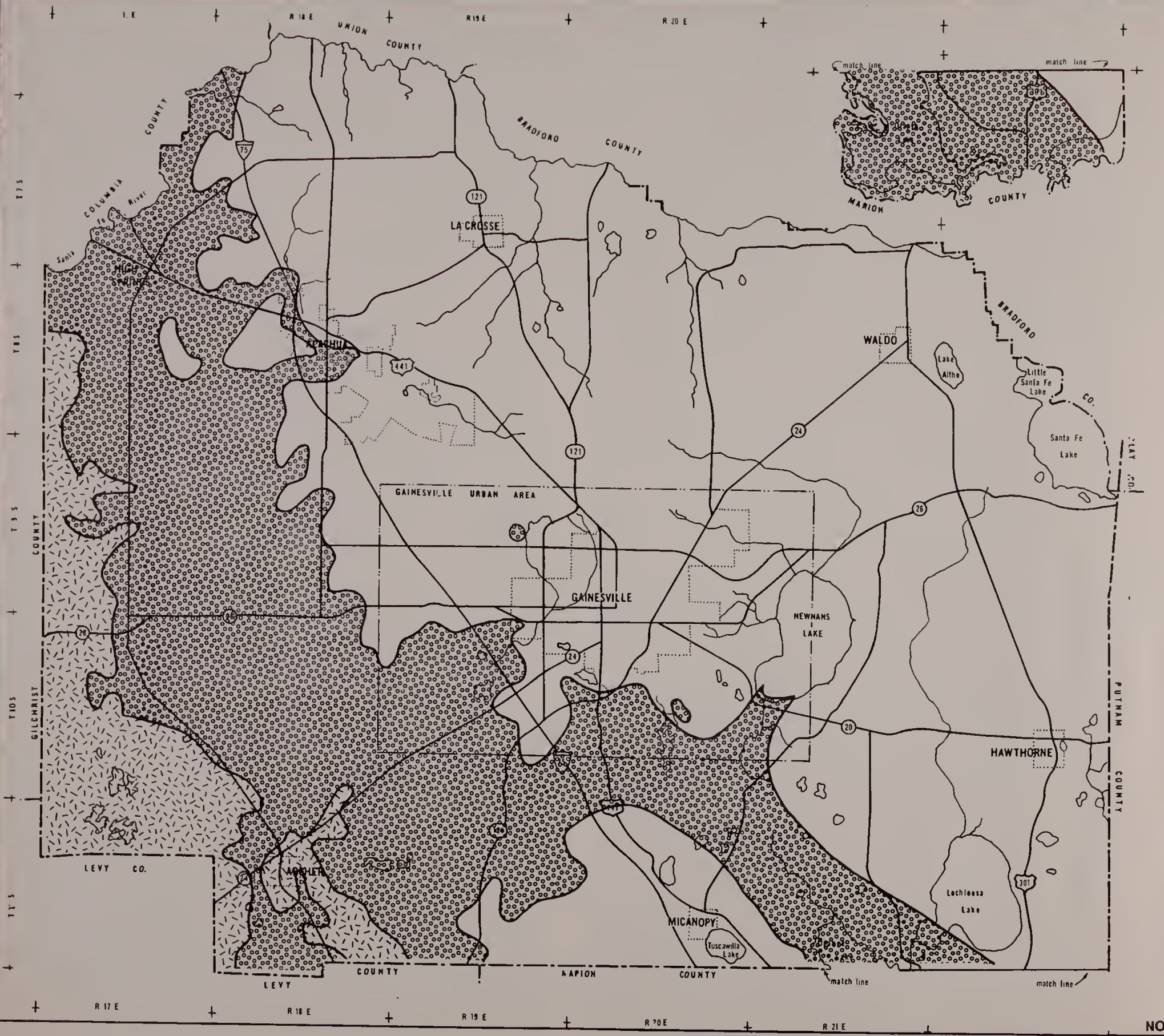
A very general water budget for Alachua County has been compiled from data contained in the Report of Investigations #35 of the Florida Bureau of Geology and a summary of the calculations presented in Table 3. It is apparent that approximately 190 MGD (million gallons per day) of water underlies and flows through Alachua County over and above that which is utilized through industry, agricultural and domestic consumption. These figures, however, are only approximations due to the limitations imposed by available data and are only intended to show the approximate magnitude of water resources in the County. Compared to the 22 MGD currently used in the County, the remaining amount of water for possible utilization in terms of volume is appreciable. Although not inexhaustable, the general magnitude of water volume appears to offer few limitations except as might be imposed on a large industry such as phosphate mining. In

TABLE 3

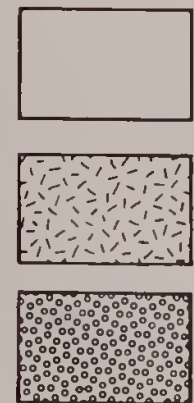
WATER BUDGET SUMMARY

	<u>Water in MGD</u>
Water Gain	
Rainfall	2,395
Subsurface Inflow	20
Surface or Stream Inflow	<u>0</u>
	2,415 MGD
Water Loss	
Evapotranspiration	1,843
Surface Outflow	
Santa Fe Basin	281
Orange Creek Basin	81
SW Area of County	<u>0</u>
	2,205 MGD
Total Water Gain	2,415 MGD
Total Water Loss	<u>-2,205</u> MGD
TOTAL GAIN:	210 MGD
Loss to Municipal, Industrial and Agricultural Users	22 MGD
Net Gain	210 MGD
	<u>- 22</u> MGD
	188 MGD

Map No. 5
**GENERAL
 RECHARGE MAP**
 FOR
ALACHUA COUNTY
 FLORIDA



INCREASING
 RECHARGE



Scale in miles

Wat

Wat

Tot

Tot

Los

Net

which case the Suwannee River Water Management District or St. Johns River Water Management District, charged with regulating consumptive water use within their respective jurisdictions would evaluate groundwater withdrawals.

Existing hydrological systems indicate a gross water production of about 200 MGD. This number is only a rough approximation and may rise or fall depending upon the management and affects of recharge alterations or modifications or the influence of large scale water withdrawals. Should phosphate mining or other large scale consumptive industry occur, based upon engineering data, the political forum would have to be utilized to evaluate trade-offs between the use of this resource with respect to any detrimental results expected from that consumption.

This large volume of water beneath the County does not necessarily imply that all that water is available for use in the County. Moral and legal questions also arise when the importance of recharge potential is evaluated in terms of Florida as a whole and the dependence of other areas of the state on the Floridan aquifer. These considerations are beyond the scope of this report; however, in summary, water supply problems in the County appear to be more problems of quality than quantity.

Groundwater Quality

In general, the concentration of substances dissolved in streams is much lower than the concentration of similar substances dissolved in groundwater, except for the water in the secondary and water table aquifers. Water from the Floridan aquifer usually has high hardness and low values

of turbidity and color. Iron concentrations are high along with bicarbonates and sulphate concentrations although the two latter values can vary greatly. Variations in water quality within the aquifer are due primarily to natural factors with the concentration of dissolved substances generally increasing progressively with depth.

The chemical quality of the upper aquifers is generally more variable with the most objectionable quality characteristics being iron, calcium and magnesium hardness and nitrate in some localities. Color is not usually a problem in the upper aquifers, however, it is significant in the Floridan aquifer in some areas of the County, i.e., in High Springs and around Paynes Prairie.

In terms of water quality, groundwater is generally considered to be excellent. Only in a few instances has groundwater been found to be of objectional quality because of excessive mineral concentration or bacteriological contamination. Instances of bacteriological contamination have been documented in past years and in all cases problems involving public water supplies have been quickly corrected. However, in recent years an increasing number of public water supplies have been found to be bacteriologically inferior by the Alachua County Health Department.

Although adequately handled and provided for in the past, provision for the proper management of surface waters and wastewater discharges to groundwater must be maintained in future years not only through agencies such as the Alachua County Pollution Control Board, but also through agencies responsible for incorporating such information into the comprehensive planning process.

Wetlands

All too often in past years, wetlands, in the form of swamps and coastal marshes either of fresh or salt water, were regarded as worthless land suitable only for landfilling or if properly channelized and drained, agricultural uses. In recent years the natural values of these wetlands have been investigated by a number of researchers and found to be tremendously important to the maintenance of natural systems.

One product of the 1972 Florida Wildlife Federation Legislative Conference was a statement recognizing the values and importance of the state's wetlands. Wetlands were noted as important for:

- 1) The protection of aquatically dependent vegetation and wildlife;
- 2) The propagation of food supplies;
- 3) The maintenance of protective barriers against floods, hurricanes and other storms and for the prevention of erosion of shorelines and soils;
- 4) The assimilation of pollutants;
- 5) The prevention of saltwater intrusion in coastal areas;
- 6) Their value as surface water storage and recharge areas;
- 7) The moderation of local climate;
- 8) Their potential to provide present and future citizens with an acceptable quality of life including historic and recreational values and esthetic enjoyment.

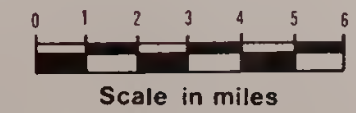
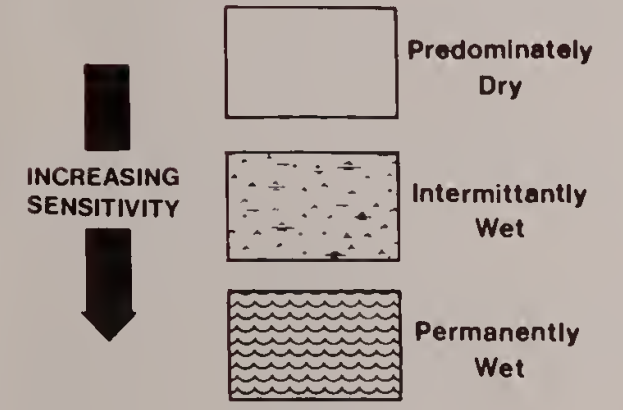
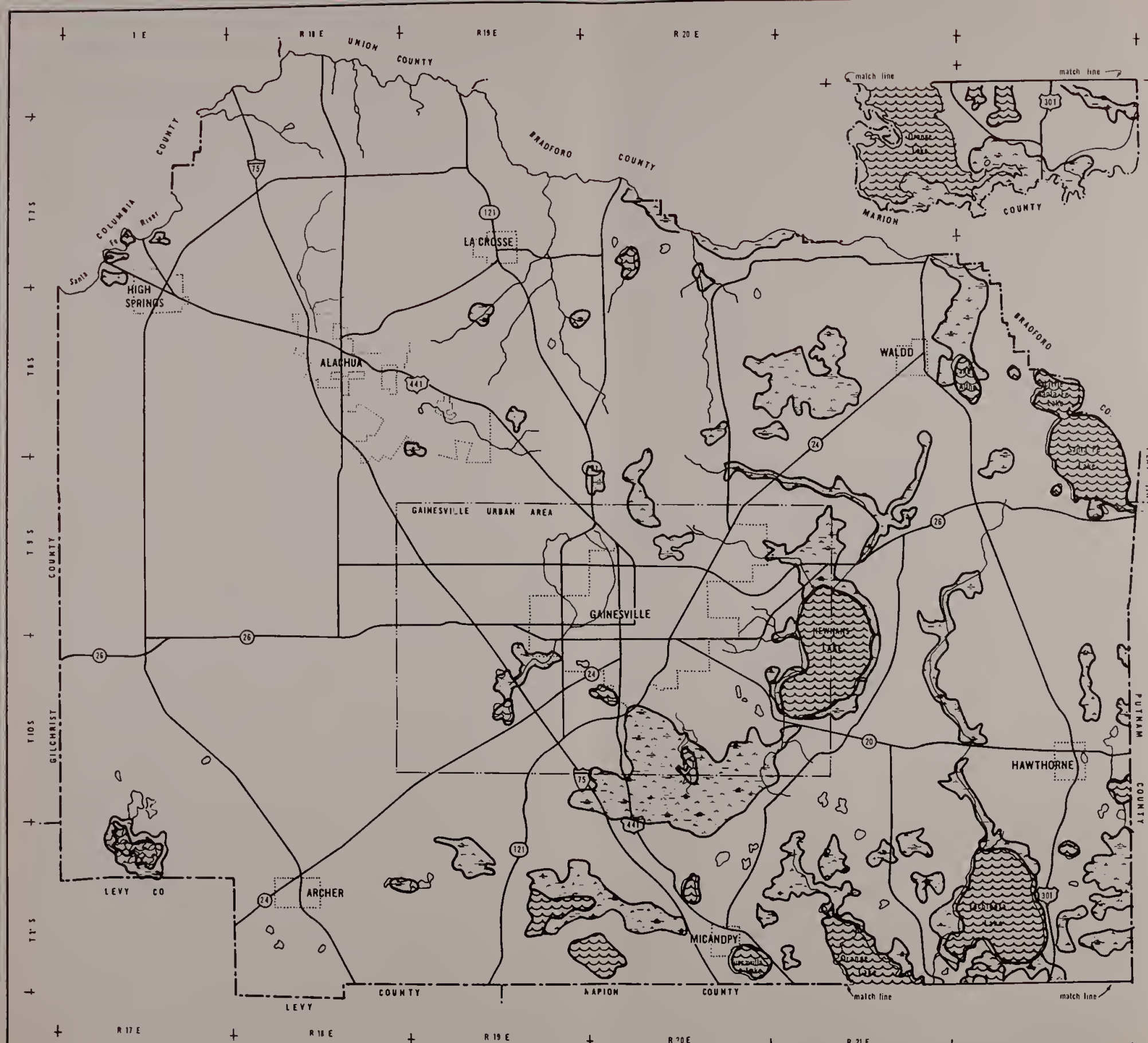
In addition, the Conference summarized that the protection and proper management of wetlands is necessary to insure the economic well being of the state and the health, safety and welfare of its citizens.

An earlier report by the North Central Florida Regional Planning Council staff entitled "Areas of Environmental Concern in Planning District III" recognized the value of one such wetland area, Gumroot Swamp, on the northern border of Newnan's Lake. This area was identified as exhibiting great natural value as protection for Newnan's Lake. Gumroot Swamp, like many other wetlands in Alachua County and the region, not only acts as a valuable natural filter by removing dissolved nutrients from surface runoff, but may be significant as a groundwater recharge area. The swamp is also used for habitats and/or spawning areas for fish and wildlife. The value of such areas to minimize the shock or impact of cultural influences on surface water bodies in Alachua County cannot be minimized.

Land use planning and subsequent development should consider such concepts as wetland ecology and resources as a viable element in the planning process. Development proposals for wetland areas should have the review of representatives of the Florida Game and Freshwater Fish Commission as well as other environment related agencies in order to provide local government with the ability to fully assess each wetland system with respect to its attributes and importance to other related systems.

Wetland systems in Alachua County have been identified on Map #6. Information contained on this map is generalized because of data limitations and the broad scale at which the map was prepared. The basic information was drawn from 7 1/2 minute U.S.G.S. topographic maps and aerial photographs of Alachua County taken in April, 1974. Areas identified as permanently wet represent those lake or swamp areas which, according to that information, exist in a perpetually wet

Map No. 6
GENERAL WETLANDS
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state. Areas defined as intermittently wet include swamp-lands, wet prairies and some lakes which because of their weed choked appearance or available information, appear only to be intermittent water bodies.

Areas not indicated on the map are assumed to be generally dry land. Because of the nature of eastern Alachua County, with its many small swamp areas scattered throughout the area, it is not possible to indicate every small wetland area; therefore, the map must be considered general in nature. In addition, because the aerial photograph utilized was taken during a "dry" season, some potentially wet areas are undoubtedly omitted or their areas minimized, therefore, the map as presented is also conservative.

Because wetlands are a valuable natural resource, they are indicated on the map by darker patterns and, therefore, are considered to provide limitations to development in the final natural resource analysis.

Flood Plains

Flood plains, although perhaps not easily identifiable as natural resources, are an important, if not indivisible, part of our natural surface water systems. They often correspond to a broad belt surrounding the existing stream channels or isolated depressions and are shaped in part by topography, storm water volume, vegetation and other natural and manmade forces.

Flood plains commonly include all those areas, including depressions, that are inundated following a storm whose severity is often judged by the water levels which could

be expected following a storm of a certain stated rainfall intensity. They are usually defined as that area which is inundated as a result of a rainfall whose magnitude and duration occurs on the average only once in each 100 years. For comparison, stream channels are often defined by that area which is inundated by a storm which occurs on the average once in every ten year period.

Flood plains provide valuable services if left in a natural state. They not only provide flood ways to remove storm waters, but when not satisfying this prime function, they may also provide useful open space areas near urban centers. In addition, wildlife may find refuge in vegetation often naturally abundant near well watered areas, ground water recharge occurs through soils during high water levels, and recreation is often enhanced in naturally viable settings.

Due to the relative infrequency of major storms and the benefits afforded by a gently sloping topography, development in and around flood plains often appears highly feasible. However, the potential for human and economic loss is usually increased. Areas with a naturally high flood potential cannot tolerate continued development which, in effect, would retard the ability of the flood plain to absorb water and restrict the flow of water from the land. Flood volume and velocity are increased downstream by development within flood plains causing downstream flood hazards. The construction of storm sewers, canals, and other stream channel improvements, may greatly alleviate potential flooding problems in urban areas. However, as evidenced by recent drainage studies for the Gainesville Urban Area, downstream flooding problems may be intensified by increasing the amount and rate of flood waters into downstream areas.

Proper management of flood plain areas is particularly important in urbanizing areas to insure against serious property damage and loss of life. In many instances the most effective technique for reducing flood damage is to enforce development regulations limiting land uses within flood plain areas. The City of Gainesville's flood control ordinance #1873 and the Alachua County Commission's efforts to conduct drainage studies for the County illustrate the public recognition of flood problems and of the need to plan for water management throughout Alachua County.

Detailed flood plain maps have been prepared for the Gainesville Urban Area through the Water Management Study prepared for the North Central Florida Regional Planning Council by Sverdrup & Parcel, Inc. Utilization of this and other information has enabled a general map of the flood plains within this area to be prepared. This map is presented in the study entitled Environmentally Sensitive Areas, 1974, prepared by the Gainesville Department of Community Development. Generalized flood plain maps have been prepared by the U.S. Geological Survey on the 7 1/2 minutes quadrangle maps for Alachua County. Because of the generality of the U.S.G.S. maps and the great amount of detail that would be lost upon reduction, flood plain maps have not been prepared for inclusion in this report. Major flood plains, however, are somewhat accounted for by the inclusion of the wetlands map which approximates the general distribution of major flood plain areas within the County. Future studies of this nature must, as new information becomes available, consider general flood plain maps at a scale consistent with study accuracy in order that they may be evaluated with respect to other natural systems.

Water Reclamation and Reuse

As water supply demands and needs increase, the reuse of wastewater will become a more attractive alternative. Even though Alachua County has, at the present time, abundant groundwater resources, those resources are finite. In the foreseeable future, because of increased growth and demands of new industry, water reclamation or even reuse may become more of a practical rather than a hypothetical problem.

Reclamation of wastewater for reuse is not a new concept. Many areas of the world including the United States, particularly inland areas, have traditionally disposed of treated waste effluents as an irrigation supply for raising a variety of crops. Many cities in north central Florida currently utilize spray irrigation as a method of wastewater effluent disposal. In a sense Alachua County has also been part of wastewater reclamation efforts for a number of years in an indirect way. That is, a large percentage of the groundwater withdrawn for domestic and industrial consumption is returned to the earth through wastewater effluents and septic tanks via percolation or sinkholes. For example, effluents from the new Kanapaha Wastewater Treatment Plant, which will employ advanced methods of wastewater treatment, will recharge the Floridan aquifer directly through deep injection wells.

Appreciable quantities of inadequately treated wastewater effluents, including storm water runoff, can, and in some instances do, have adverse impact on groundwater quality. The County has had in the past instances of groundwater pollution directly attributable to wastewater discharges. Although quickly remedied, it is almost certain that such

instances can occur again if groundwater systems and resources are abused.

Although progress has been relatively slow in the United States, the State of California has conducted expensive experimentation in water reclamation. As a result, the California Water Resources Control Board has officially approved reclaimed water for all water contact sports such as fishing, boating, swimming and water skiing. From these examples it appears that the future of wastewater recycling is optimistic; however, there are still a number of problems and drawbacks of water reclamation which must be considered.

Opponents to wastewater reclamation and reuse refer to the problems encountered in Europe after World Wars I and II, where outbreaks of disease occurred resulting from wastewater irrigation of fields. In addition, recent research has shown that the infectious dose of numerous viruses is extremely low; enough virus can exist in the average city water supply to produce as many as 600 clinical and non-clinical infections daily. Bacteriological research has revealed such things as the existence of a chlorine resistant bacteria, significant because chlorine is the primary purifying agent in water treatment. Treatment processes necessary to allow waste water use for human consumption or contact activities are costly. This expense factor restricts their utilization.

Despite these problems, there are methods of water salvage and conservation which are currently effective and others currently under research which could be considered for Alachua County should the need become evident in future years. These

methods include vegetation management, which would conserve those types of vegetation contributing to lower losses of water due to evapotranspiration. Water conservation methods are numerous and would include modification and landscaping techniques, changes in municipal operations such as street washing, more effective water metering and redesign of appliances to reduce water consumption, long range forecasting of climatological conditions and resulting advance planning and modification of irrigation techniques. The consideration of these methods can be facilitated by a reasonable regional approach. Proper planning can reduce costs in the number of facilities and personnel, as well as maximum pollution control.

In future years it should be anticipated that agencies such as the Alachua County Pollution Control Board, the Suwannee River Water Management District, the St. Johns River Water Management District and various planning agencies will take a more active role in water resources planning including provisions for wastewater reuse and reclamation.

SOILS

Introduction

Soils may be defined as distinct three dimensional bodies of material lying at the earth's surface limited by the atmosphere above, bedrock or transitional rock material below and other soil bodies laterally. They have formed as a result of interacting physical, chemical and biological processes and have been conditioned by relief over periods of time to form a mixture of weathered rock material and minerals, organic matter, water and air in varying proportions.

Soils are demonstrably important in all formal and informal planning activities because almost every activity of man is necessarily limited to a basic starting point, soils. Factors associated with soils such as water table location, rock or clay content, thickness and variety of other engineering parameters limit the uses to which a soil can be placed. Therefore, because there are many characteristics that may be utilized to assess the uses for general types of soils, literally hundreds of combinations or suitability interpretations are possible for each soil or combination of soils.

Soils and Planning

Early investigations into soil types were promoted by the growth of our agricultural oriented society coupled with the needs of an expanding nation into a new continent. Further impetus for use of soils information was brought about during World War II when engineering interpretations of soil capabilities were necessary to adequately plan for military construction and operation. Since the early 1950's

detailed soil surveys coupled with in-depth soil analysis and interpretation have shown that soils information is valuable for both general and operational planning, particularly if soil suitability interpretations have been prepared by soil scientists.

The first detailed soil survey in Alachua County was conducted in 1937-40 by the Division of Soil Survey, Bureau of Plant Industry, Soil and Agricultural Engineering, U.S. Department of Agriculture and the Florida Agricultural Experiment Station. This analysis was oriented towards assessing soil capabilities for agricultural uses, and soils were only evaluated to a depth of 30 inches. At present, the Soil Conservation Service is conducting a five year program to complete a detailed, modern soil survey for Alachua County. During this process soils will be evaluated to a depth of two meters (about six feet) and a wide variety of soil suitability interpretations differentiated on the basis of the potential uses and specific attributes of each soil type.

The general soil suitability maps which are utilized in this study are adequate for broad land use planning because they facilitate an overall evaluation of soil capabilities early in the planning process. However, the detailed soil maps that are presently being produced will provide interpretive information on soil limitations and hazards for a variety of land uses and will be an even more valuable guide to comprehensive land planning. Individual site explorations will still be recommended in site planning for high intensity land uses.

The soils in Alachua County are presently grouped into 18 different groups or soil associations in which the predominant soil types of each association form a part of the association

name. Soil ratings and limitations have been assigned through a careful evaluation of each general soil type including assessments of value for sanitary facilities, community development, water management, recreation, agriculture uses, wildlife habitat, and sources of construction material. Each of these suitability classes was formulated specifically to provide information to conduct general planning for different types of land uses.

Table 4 below lists and describes general soil associations found in the general soils map of Alachua County (Map #7).

TABLE 4
SOIL ASSOCIATIONS OF ALACHUA COUNTY

Areas dominated by sandy droughty soils not subject to flooding:

1. Candler-Apopka association: Nearly level to strongly sloping excessively drained soils with very thick sandy layers underlain by sandy layers containing thin loamy or sandy loam lamella, and well drained soils with very thick sandy layers over loamy subsoil.
2. Jonesville-Chiefland-Archer association: Nearly level to sloping excessively drained soils with very thick sandy layers over loamy subsoil, and well to moderately well drained sandy soils with loamy or clayey subsoil underlain by limestone.

Areas dominated by well drained soils not subject to flooding:

3. Arredondo-Zuber association: Nearly level to sloping well drained soils with very thick sandy layers over loamy subsoil and well drained soils with thin sandy layers over loamy or clayey subsoil.
4. Hernando-Archer-Chiefland association: Nearly level to gently sloping moderately-well to well drained sandy soils with loamy or clayey subsoil, underlain by limestone.

5. Kendrick-Hague-Zuber association: Nearly level to sloping well drained soils with very thick sandy layers over loamy subsoil and well drained soils with thin sandy layers over clayey subsoil.

Areas dominated by moderately well to poorly drained soils not subject to flooding:

6. Tavares-Myakka-Basinger association: Nearly level to gently sloping moderately well drained soils sandy throughout and poorly drained sandy soils with weakly cemented sandy subsoil and poorly drained soils, sandy throughout.
7. Stilson-Pelham-Mascotte association: Nearly level moderately well and poorly drained sandy soils with loamy subsoil and poorly drained sandy soils with a weakly cemented sandy subsoil layer underlain by loamy subsoil.
8. Sparr-Lochloosa-Tavares association: Nearly level to sloping somewhat poorly drained soils with very thick or thick sandy layers over loamy subsoil and moderately well drained soils, sandy throughout.
9. Blichton-Flemington-Kanapaha association: Nearly level to strongly sloping, poorly drained soils with thick sandy layers over loamy or clayey subsoil and poorly drained soils with very thick sandy layers over loamy subsoil.
10. Scranton-Basinger-Myakka association: Nearly level to gently sloping somewhat poorly drained very thick sandy black surfaces, poorly drained soils sandy throughout and poorly drained sandy soils with weakly cemented sandy subsoil.
11. Lynne-Pomona-Popano association: Nearly level poorly drained sandy soils with a weakly cemented sandy subsoil layer underlain by loamy or clayey subsoil and poorly drained soils, sandy throughout.
12. Myakka-Wauchula-Placid association: Nearly level poorly drained sandy soils with weakly cemented sandy subsoil and poorly drained sandy soils with a weakly cemented sandy subsoil layer underlain by loamy subsoil and very poorly drained soils, sandy throughout.

13. Meggett, Var.-Wauchula-Chobee association: Nearly level poorly drained soils with thin sandy layers over clayey subsoil and poorly drained sandy soils with a weakly cemented sandy subsoil layer underlain by loamy subsoil, and very poorly drained soils with very thick loamy layers, over sand.
14. Eureka-Paisley-Eaton association: Nearly level poorly drained soils with thin sandy layers over clayey subsoil and poorly drained soils with thick sandy layers over clayey subsoil.

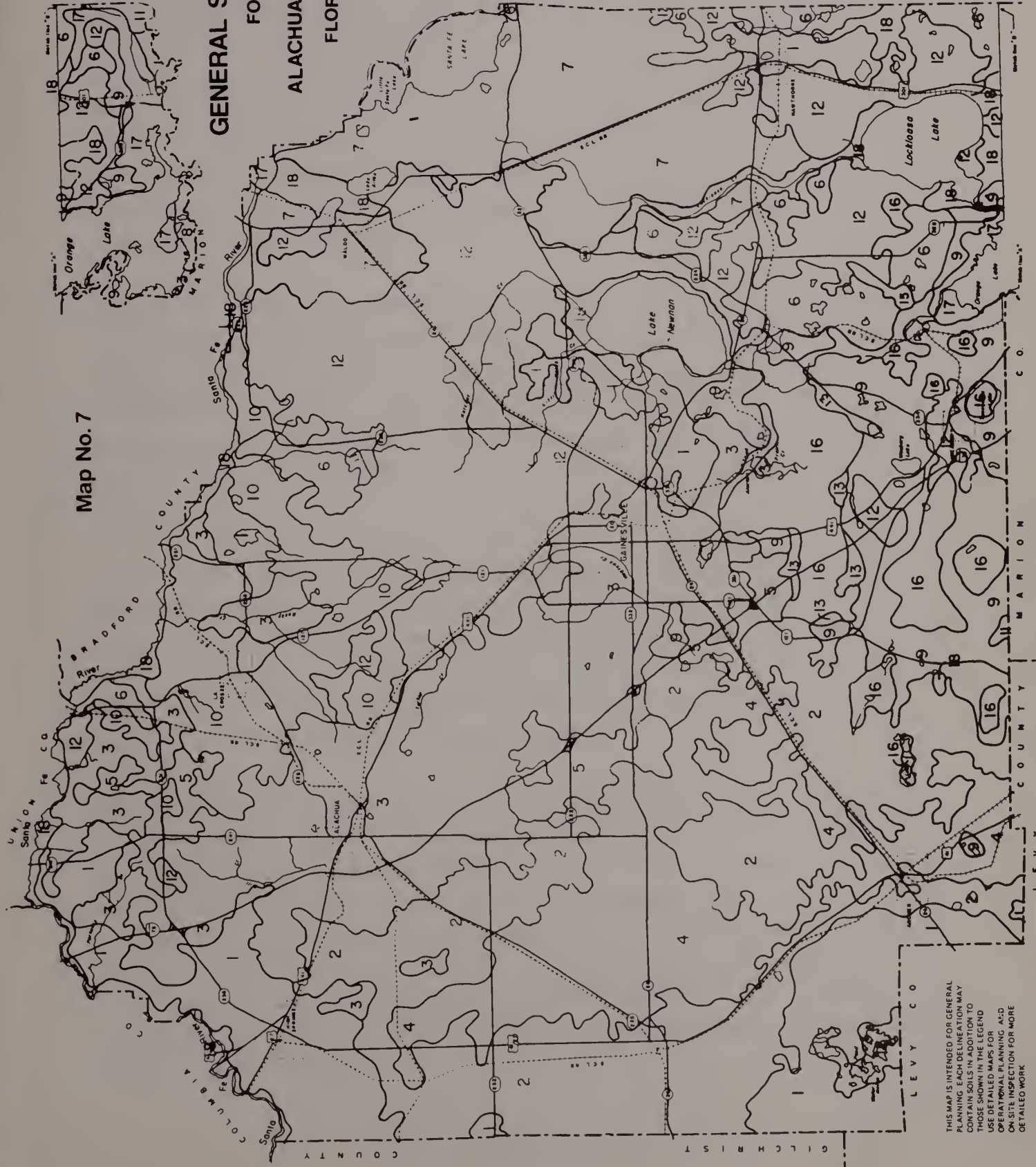
Areas dominated by poorly and very poorly drained soils subject to flooding:

15. Plummer, Var-Rutlege Var. association: Nearly level poorly drained soils with very thick sandy layers over loamy subsoil and very poorly drained soils, sandy throughout.
16. Martel-Placid association: Nearly level very poorly drained soils with thin loamy layers over clayey subsoil and very poorly drained soils sandy throughout.
17. Okeechobee-Terra Cela-Tomoka association: Nearly level very poorly drained soils, organic material more than 50 inches thick, or organic materials 16 to 40 inches thick over sand.
18. Fresh Water Swamp association: Nearly level very poorly drained soils subject to prolonged flooding.

Source: General Soils Atlas for Planning
Districts III and IV.

Methodology

For the purpose of assessing the suitability of soils for community development, a soil scientist from the Alachua County office of the U.S. Soil Conservation Service grouped the 18 soil types of Alachua County into six very general categories based on suitability for community development. In this case, assessing soils suitability for community development includes



Map No. 7

GENERAL SOILS MAP FOR ALACHUA COUNTY FLORIDA

See Table 4 for
Soils Description

Source: General Soils Atlas
for Planning Districts
3&4

THIS MAP IS INTENDED FOR GENERAL
PLANNING. EACH DELINEATION MAY
CONTAIN SOILS IN ADDITION TO
THOSE SHOWN IN THE LEGEND.
USE DETAILED MAPS FOR
OPERATIONAL PLANNING AND
ON-SITE INSPECTION FOR MORE
DETAILED WORK.

a consideration of soil properties that effect footings and foundations for housing and other light weight buildings, a consideration of soil properties that affect growth of plants used for landscaping and those that affect trafficability of streets, as well as consideration of wetness, available water capability, fertility, weight bearing capacity and flood hazards. In addition, septic tank suitability closely parallels community development potential.

Therefore, for the purposes of this section soils are mapped according to their general suitability for community development. It must be noted, however, that in many instances limitations for such development can be overcome by modern engineering technology. In addition, soils suitability maps may be revised and updated as the current soil survey reaches completion.

On the other hand, with large areas of soils generally suitable for community development, sound land use planning may aid in directing growth away from many areas with poor soils suitability in future years. Therefore, provision for such areas must be an important consideration in planning for growth and development of the county.

Map #8 has been prepared to illustrate the general distribution of soils types in Alachua County as they relate to their suitability for community development. Such a guide is necessarily limited to the level of sophistication or accuracy to which the general soils map of Alachua County was prepared. Therefore, this map like other maps prepared in this text is only suitable for general planning activities. For specific site details the use of an up-to-date modern soil survey is recommended.

Table 5 summarized the groupings of soil associations that were utilized in the preparation of the soils suitability map for community development, noted as Map #8 in the text.

TABLE 5
SOIL SUITABILITY FOR COMMUNITY DEVELOPMENT
ASSOCIATION CHART*

Group Number	Group Composite Name	Soil Association Components From General Soils Map
1	Chandler, Jonesville, Arrendondo Association	1, 2, 3
2	Hernando, Kendrick Association	4, 5
3	Tavares, Stilson, Sparr Association	6, 7, 8
4	Scranton, Lynne, Myakka Association	10, 11, 12
5	Blichton, Maggett, Eureka, Plummer, Martel Association	9, 13, 14, 15, 16
6	Okeechobee, Swamp Association	17, 18

*In order of decreasing suitability for community development

Map No. 8
**GENERAL SOILS
 SUITABILITY MAP**
 FOR
ALACHUA COUNTY
 FLORIDA



DECREASING
 SUITABILITY
 FOR
 COMMUNITY
 DEVELOPMENT

	Chandler, Jonesville, Arredondo Assn.
	Hernando, Kendrick Assn.
	Tavares, Stillson, Sparr Assn.
	Scranton, Lynne, Myakka Assn.
	Bilchton, Eureka, Plummer, Martel Assn.
	Okeechobee Swamp Assn.

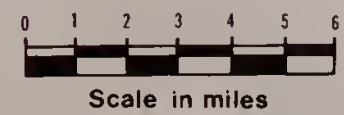


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TOPOGRAPHY

General

Topographic information is of critical importance to planning because topographic features, reflecting variations in height and degree of slope, affect the ecology of an area and the suitability of the land for development. More specifically, topography often greatly influences the type and cost of development, controls the rate and direction of water runoff, contributes to landscape esthetics, influences weather and climate and affects the type and amount of vegetation and wildlife.

Topographic information can be obtained from several sources especially in the form of maps or aerial photographs. The most commonly available maps are from the United States Geological Survey (USGS), a division of the Department of the Interior. The Geological Survey Office produces standard topographic maps covering the entire United States. Each map is bounded by parallels of latitude and meridians of longitude. These "quadrangle" maps are produced in three series: a 7 1/2 minute series covering 7 1/2 minutes of latitude and longitude at a scale of 1:24,000; a 15 minute series covering 15 minutes of latitude and longitude at a scale of 1:62,500; and a 30 minute series covering 30 minutes of latitude and longitude at scale of 1:125,000.

The USGS maps contain three basic types of data: cultural features, water features, and topographic relief. Cultural features include roads, railroads, cities and towns. Water features include lakes, rivers, streams and major intermittent channels. Topographic relief is shown with contour lines and spot elevations. Some maps include additional information such as woodland areas, limits of urbanized areas, highway classifications and the boundaries of major public land areas.

Maps which show topography and other features for much of Alachua County, in addition to the USGS maps, can be obtained from the Florida Department of Transportation, and the North Central Florida Regional Planning Council. Aerial photographs are available for purchase or examination for many areas of the County through the North Central Florida Regional Planning Council, the office of the County Forester or the County Courthouse. Such photos are often quite useful in assessing subsurface structures, drainage patterns, vegetation coverage and land use.

County Topography

Alachua County is located in the topographic division of Florida known as the Central Highlands and may be divided into two major land resource areas each typified by a characteristic physiography. The North Central Florida Ridge area is described as having a gently undulating land surface. In contrast, the Atlantic Coast Flatwoods area is generally of low, somewhat flat terrain having numerous swamps and large shallow lakes. Elevations in Alachua County generally range between 50 and 210 feet above sea level.

The topography of the County owes its character to two major factors. The first involves alternating advances and recessions of the sea during each of the major Pleistocene (10,000 to 2,000,000 year ago) ice ages. Terraces or wave-cut beaches eroded into local land surfaces wherever each advance remained stationary before ultimately retreating. As many as five terraces represented as hills or rises in local land surface ranging to over 200 feet in elevation have been identified in Florida. At least two of these terraces, the Okefenokee, at about 150 feet elevation, and the Wicomico, at about 100 feet elevation have been identified in Alachua County.

The second factor is the solution by ground and surface waters of the relatively soft limestone formations underlying much of the area. The term karst topography is used where such solution has served to divert waters to underground routes or create lakes by forming depressions in the limestone down to the ground water level. Such differential solution has been a significant factor in creating lakes, eliminating surface drainage by streams, and forming sinkholes in some parts of the County.

Much of the north and northeastern portion of Alachua County is a nearly level plateau-like area varying in elevation of 150 to 200 feet. Relatively impermeable clayey sands beneath the sandy surface soils have caused stream drainage to develop radially outward from the plateau most likely served as a natural drainage divide between the Atlantic Ocean and the Gulf of Mexico. Some of the present drainage still reaches the Gulf by way of the Santa Fe River to the Suwannee River and then to the Gulf. Many swampy areas occur throughout the plateau. These areas owe their water retention capabilities to underlying impermeable clays beneath the surface sands.

The western portion of Alachua County is a plains region having elevations ranging from approximately 50 to 100 feet and notably characterized by the lack of a surface drainage system. The Hawthorne formation, which probably overlaid this area in geological past, has been removed by erosion or carried away in solution often leaving the deeply pitted and eroded Ocala limestone within a few feet of the surface, covered with a thin layer of sand. The sands or clayey sands lying above the Ocala limestones tend to mask the irregularities of the limestone surface and often form sandhills or ridges in the southwestern part of the County. The solvent action of ground water is more evident on this plain than any other part of the County. Sinkholes and other solution features are common.

The south central and southeastern portions of Alachua County are characterized by flat bottom lakes, prairies, and erosional remnants of the plateau. Paynes Prairie, Levy Lake and Kanapaha Prairie are examples of this area. The level bottoms of the prairies and lakes have been observed to occur somewhat uniformly at elevations slightly below 60 feet above mean sea level (MSL). The three different types of flat bottomed depressions all appear to be dependent upon local ground water levels.

Influence of Topography

Urban development tends to follow the direction of least topographic resistance dependent only on limitations imposed by modern technology. It may often be observed that rivers and valleys tend to channel urban expansion; major highways and railroads tend to follow river channel routes because of the generally gradual continuous grades; and bridges that often open up new areas for development tend to be constructed at the narrowest points of rivers of where the river is shallow and exhibits a hard bottom and easy access grades. Therefore, topography to a large extent helps shape patterns of growth.

Topography, or land form, interacts with those physical characteristics that help shape or form it, such as type of soils, drainage pattern, climate and vegetation. Therefore, because of its imposition on the natural environment, land development must insure the stability of topography during the physical development of sites by providing adequate grading (slope stabilization), drainage and soil structures in order to make the best use of the construction site within the limitations set by the topography.

There are almost no areas in the County that possess topographic limitations so great as to preclude specific types of development. Modern engineering practices can override almost all limitations if economics are not a problem. However, there are areas which do lend themselves to particular uses because of topography.

One concept specifically concerned with the limitations to development as imposed by topography is referred to as slope use zoning. This concept revolves around the maxim which maintains that within the framework of construction practices and technology there are certain slopes, or ranges of slopes, upon which certain types of construction can be most economically undertaken.

It has been observed that on certain specific slopes the cost of construction to meet the common needs of certain land uses will be minimized. This cost of construction, as reflected in the consumer cost, includes not only the cost of the structure, but also the costs of site preparation, site development, utility services and the provision of necessary drainage facilities and access roads. Some of the basic provisions of the slope use zoning concept are outlined in Table 6.

The reader is referred to the report entitled "Housing, 1974", prepared by the North Central Florida Regional Planning Council for further discussion on slope use zoning and limiting effects of topography on development.

TABLE 6
GENERAL SLOPE USE ZONING

<u>Slope</u>	<u>Limitations</u>
0-1%	Drainage problems make many types of development unsuitable. Limited farming and large scale lineal production industry are often economically feasible.
1-5%	Commercial and residential developments of all types are feasible because of generally good natural drainage and easy slopes. Good general farming potential. Roads begin to follow topographic contours.
5-12%	Small scale commercial structures and intensive small industry feasible. Terrace type landscaping favors clustered single family residences on large lots and roads are generally parallel to contours. General farming from 5-8%, specialized farming to 12%.
over 12%	Industry and commerce usually economically impractical. Isolated single family residences on large lots are feasible. All types of roads become expensive and only specialized farming is practical.

The effects of erosion increase directly with degree and length of slope; therefore, it is sometimes desirable to establish constraints to development based upon slope. As exhibited on Table 6, low slopes are usually highly desirable for residential development because they are usually well drained, easier to build upon than steeper slopes, and do not impose limitations to vehicle access. However, even on low to moderate slopes, precautions may need to be taken to retard or prevent serious erosion, especially during construction stages of development.

Contigent upon soil and bedrock conditions, slopes over 10% generally impose greater construction problems and costs in order to insure slope integrity and the stability of structures on such slopes. While steep slopes do provide opportunities for creative architecture and site planning and may be desirable from an esthetic point of view, increasing density of units often creates other potentially hazardous conditions which must be anticipated early in the planning process.

In general, very steep slopes are unsuitable for any form of urban, agricultural or forestry use because removal of trees and other vegetation produces rapid erosion, resulting in sedimentation in streams and heightening of flood peaks. Such slopes are most appropriately reserved for limited recreational uses.

In Alachua County slopes are not generally found in extremes. The greatest topographic problem areas in the County are those having very low or flat slopes exhibiting poor drainage and which often appear as wetlands on topographic maps. Only small areas appear to have excessively steep slopes, and those primarily occur along narrow stream margins. Moderate to steep slopes are generally found in those areas of the County where the topographically higher sand terrace deposits grade westward and down to the Hawthorne formation and subsequently to the limestone plain of western Alachua County.

In all but a few areas, steepness of slope does not impair development potential. Due to modern engineering technology and the desire for an esthetically pleasing environment, limited development often occurs in areas of moderate to steep slopes. As long as proper development limitations and controls are

observed during development and in early planning stages, limited areas of moderate to steep slopes in the County only pose serious threats when located or developed in such a manner as to create undue adverse environmental impact. Such impact could result in part from the destruction of natural vegetation causing increased erosion and sedimentation, the destruction of valuable areas of unique river forest vegetation, inadequate provisions for surface runoff in terms of both quality and quantity into natural water courses, and site deterioration caused by a poor accounting of soil, water table and bedrock properties during the planning process.

Areas of very flat slopes cover significantly large areas in the County and usually exhibit other properties which identify them as having poor or limited development potential. These might include poor soil suitability for development, flood plain designation, low relief with typical lowland topographic characteristics such as a high water table and lowland vegetative species. Areas such as these are readily apparent in the County and include those large areas of prairie in south central Alachua County and also include significant areas of low relief such as exhibited in the headwaters areas of Hatchet Creek in the northern portion of the Gainesville Urban Area.

For the purposes of this publication no map has been prepared illustrating topographic features in the County. The rationale for this exclusion concerns problems of map scale. Areas in the County having steep slopes are of such limited areal extent as to make them almost indistinguishable on the scale utilized in this report. Large areas of relatively low slopes on the other hand, are readily identified on available topographic maps and in most cases, because of other characteristic features such as their vegetative or wetland nature, otherwise reflect topographic influence.

CLIMATE

General

Climate is a natural resource in that it permits or facilitates many types of activities or land uses otherwise restricted to other geologic localities. The impact of climate is exemplified by a consideration of its impact on outdoor activities, such as year round recreation and farming which are quite apparent and others such as energy consumption which are not as apparent but equally significant. Climate then is an integral resource of the area because it helps shape or modify virtually every other resource as well as human activity and environment.

Climate in Alachua County

A brief description of the climate and sources of climatological data in Alachua County was included in the Water and Sewer Development Plan for Alachua County (1974) and is incorporated herein as follows:

The climate in Alachua County is mild, with a mean annual temperature of 70.2 degrees and an average yearly rainfall of approximately 52 inches. Precipitation varies widely from year to year, particularly in the summer months. Alternating wet and dry cycles of several years duration are observed. Most of the rain, an average of about 36 inches per year, is tropical in nature, falling during the summer months as thunder showers. About 16 inches of the yearly average comes as winter rain of the cyclonic or frontal type, usually slow and drizzly and followed by a drop in temperature.

The yearly average temperature for the summer months varies little from year to year, but wider variations is observed during the winter when cyclonic storms frequently bring cold weather from the north. Frost depends upon these storms. Killing frost can be expected, on the average, over an 80-day period each year, from December 4 to February 22. Fog occur during 30 to 40 days each year, generally in the early morning and winter. The area has never received serious damage from hurricanes and chances for a hurricane within any one year are considered to be in the 3 to 4 percent range.

Climatological data can be obtained from the U.S. Weather Bureau publications for five stations within the County. Two of these stations are in the Gainesville Area and the other three are located in High Springs, Melrose and Island Grove. The one station at Gainesville, 3 WSW, keeps records of precipitation, temperature, and evaporation and has both recording and non-recording gages. This station also keeps records of soil temperatures at various depths. Records cover a period of 15 years, beginning in 1953. Precipitation and temperature records for the area are also available for a period of more than 60 years up to and including 1956, from the old University of Florida Station at Gainesville. Table 7 has been reproduced from the above referenced publication and shows the average monthly temperature and rainfall in Gainesville.

TABLE 7
AVERAGE MONTHLY TEMPERATURE
AND RAINFALL
FOR THE PERIOD 1931-60
ALACHUA COUNTY

Month	Average Temperature (degree F)	Average Rainfall (inches)
January	58.0	2.60
February	59.6	3.27
March	63.6	4.11
April	69.5	3.72
May	75.8	3.48
June	80.1	6.64
July	81.1	7.49
August	81.2	7.69
September	79.2	4.95
October	72.1	4.23
November	73.7	1.75
December	58.5	2.52

Source: Water and Sewer Development Plan for Alachua
County.

Influence of Climate

In general, there are eight primary determinants of climate quality that influence urban structure and development:

(1) latitude; (2) altitude; (3) land form; (4) water bodies; (5) temperature; (6) wind; (7) humidity and (8) precipitation.

In addition, one other attribute of climate, air quality, warrants note. Variations in combinations of these determinants results in the wide variety of local climatic conditions.

Of these primary determinants, latitude determines the amount of time during which the sun can shine on any day of the year.

In general, latitude as it relates to distance from the equator directly relates to average temperature. Altitude, in a state with elevations ranging to only about 400 feet, is not a major factor in modifying climatic conditions.

Where all other influences on local climate are constant, variation of landform will result in variation of climate. The principal determinant is dependent upon slope orientation.

Water bodies such as rivers and lakes have a great influence on climate. Because water temperatures fluctuate slower than air temperatures, bodies of water tend to equalize temperature extremes. Temperature is not only influenced by latitude but by the nature of the land surface upon which development takes place. The heat absorbative qualities of landforms and vegetation is significant in planning local environmental conditions.

Wind has a decided affect on the temperature preceived. The human body is cooled by the evaporation of perspiration achieved by air movement and low air humidity. In warm weather, anything that reduces air movement or increases humidity will give the impression of greater heat. The heat loss or cooling effect of both people and buildings is also affected by wind. Landforms, landscaping, vegetation and structures all influence the impact of wind on local environment. Humidity and precipitation are certainly significant in how they influence land use and urban development. However, modern technology has not yet progressed to the point where these factors affecting climate quality can be significantly influenced.

Air pollution in the form of vehiclular pollution and waste from industrial and power plants as well as noise, which is being recognized as a major pollutant, might also be considered climatic components. Fortunately however, neither is a significant problem to Alachua County.

A more complete site planning oriented discussion of these factors is contained in the publication entitled Housing, 1973 prepared by the North Central Florida Regional Planning Council. That discussion describes the more important of these aspects that pertain primarily to local climatic considerations in Florida.

Because climate is a resource, it is important to be generally aware of its characteristics and affects. However, because climate is a relatively fixed or constant resource and because climatic modifications can, in general, only be economically feasible when influenced on a local scale, further discussion is unnecessary to the scope of this report.

VEGETATION

Agriculture

General

As population increases throughout the world, there is every reason to expect the demand for agricultural products to continually increase. In addition to the high demand for agricultural products, other problems indigenous to our modern society must be overcome if our full potential for agricultural growth is to be achieved in the future. These problems include: increasing urbanization and the subsequent removal of prime agricultural lands from production, the economics of agriculture in a rapidly changing economic state, the effect and subsequent management of this large land use as it affects our quality of life and the environment, and lastly, meeting the growing demand for agricultural products for our own expanding population.

Agriculture, grazing and forestry are first elements in the use of the land. Although the production of food and fiber can be viewed as renewable resources, because of tremendous increases in population pressure, it has become apparent that productive land is almost beyond value.

In addition to the increased importance placed upon agriculture to fulfill its traditional role in the production of food and fiber, the concern for the environment has highlighted other values of agriculture as a land use. In many instances preservation of agriculture as a land use has been enhanced through legislation such as Florida's program for Areas of Critical

State Concern. This recognition has been fostered through an appreciation of agriculture because of the open space it affords and the asthetic contribution provided by this land use.

Agriculture in Alachua County

Due to the increase in population and its changing characteristics, the way in which land is used in the region has changed. The primary land use in Alachua County during the early 1900's was agriculture. At the present time, however, there are two basic land use patterns found within the County, i.e., agriculture and urban. Agriculture land use has retained its dominance and is still the primary land use category utilizing 373,774 acres or 65% of the total land area in the County.

In addition to agriculture, land use patterns of the County have been influenced to a great degree by large tracts of commercial forestry. Commercial forestry is classified as an agricultural land use and makes up 45% of all agricultural lands and 53% of the total land in Alachua County.

While the contribution of agriculture to the County's economy is not too significant when measured in terms of employment, it is vital when viewed with respect to its dollar value. It is estimated that the total value received for farm products in Alachua County is approximately \$30 million annually. In terms of value, the three leading products are poultry, beef cattle and forest products. Table 8 summarizes the acreage and values of crops produced in 1974 by the 1,172 farms in Alachua County.

TABLE 8

ACREAGE AND VALUE OF AGRICULTURE IN ALACHUA COUNTY
IN 1974

<u>CROPS</u>	<u>ACREAGE</u>	<u>TOTAL VALUE</u>
Tobacco	1,721	\$ 2,400,000
Corn	40,000	2,000,000
Vegetables	8,500	2,100,000
Watermelons	4,100	950,000
Peanuts	1,950	1,750,000
Sugar Cane	700	10,000
Hay	30,000	---
Lupine	500	---
Indigo	8,500	---
Citrus	650	200,000
Pecans	3,000	350,000
Forestry	168,000	4,500,000
Beef Cattle	66,000	5,500,000
Hogs	28,000	1,750,000
Horses, Goats, Sheep	---	750,000
Dairy Products	---	1,600,000
Poultry and Products	80,000	5,500,000
Permanent Pasture	150,000	---
Millet, Oats, Wheat, Rye, Sorghum, and Silage	27,350	---
Nurseries (58)	---	<u>600,000</u>
TOTAL LESS SUBSIDIES AND OFF FARM INCOME:		\$34,960,000

Source: Alachua County: Long Range Plan, 1975-1985,
USDA Agricultural Extension Service.

Problems and Values of Agricultural Land

In developing natural land for agricultural uses native vegetation is cleared away and crop plants maintained in their place. In brief, a naturally diverse community is replaced with a monoculture. Herbicides and insecticides are commonly used to maintain and optimize the growth of a few preferred plant species and to help prevent their utilization by organisms other than those beneficial to man. As the size of agricultural fields and the intensity of their management increase, their value to species other than man diminishes. Frequently the side affects of intensive land management, such as runoff with its load of fertilizers, pesticides and soil, has an adverse impact beyond boundaries of the land being managed. These and other problems related to farming present potential hazards to neighboring ecosystems as well as to the agricultural land itself.

Water and wildlife may be used as two examples to illustrate unnecessary resource depletion where conservation practices are not efficiently utilized. Because water control and development require a delicate balancing of all hydrologic, economic and human influences within watersheds, cultivation and cropping practices must have an essential regard for water control on a local as well as regional level. Damage to wildlife may result primarily through a reduction in habitat where cover, feed and water are removed or altered from the natural state. Although a considerable amount of this is to be expected with some agricultural uses of land, good conservation farming employing the practices of grass waterways, vegetated slopes, farm ponds and other modifications often results in the support of more wildlife compatible to farms.

Although there is little doubt that crop land development and use may have an adverse impact on related resources such as forest and prairies, some of this development is justifiable because of the high priority that necessarily must be assigned to agricultural land. Therefore, because of economics, product need and demand and the intangible values attributed to land for this use, conservation approaches to agricultural land should be continually encouraged. This type of encouragement is being provided in Alachua County by the County Agricultural Extension Service, the Soil Conservation Service and the Soil Conservation and Stabilization Service, which consider all elements of the resource base. In addition, because agriculture has become an important aspect of the ecology of the County, the retention of well managed and productive farm lands should be considered equally important as forest and swamps areas.

In addition to the problems described as indigenous to the proper management of farm lands such as those concerning erosion, irrigation and agricultural runoff, a number of other problems have been identified by the Alachua County USDA Agricultural Agent. These problems, many of which are common to all farmers, must be recognized at an early stage of land use planning in order that proper consideration may be made wherever possible through the comprehensive planning process. These problems include:

1. Increasing farmland prices will make it difficult for young people to become farmers in the future unless they have grown up on a family farm.
2. There is a need for more research and educational programs on agricultural land management, including pest, weed and disease control.

3. Urban sprawl and the breaking up of farms due to economic pressures to developers is slowly but continually reducing the amount of farmland available for agriculture in the County.
4. Land prices may more than double during the next ten years making it very difficult for farmers to expand their working base.
5. Property taxes are anticipated to double during the next five years and triple in the next ten years.
6. Increasing portions of farmland in Alachua County will be irrigated in future years, thus making it necessary to insure adequate water allocations for irrigation through water resources planning.

Agriculture and Soils

Because the type, quantity and quality of any vegetation depends in large degree upon the type of soil in which that vegetation occurs, planning around soil types is integral to good agricultural land management.

The U.S. Soil Conservation Service has established a capability classification for soils by which soil groups are categorized as to their general suitability for agricultural use. This is a practical grouping based upon limitations of the soils, the risk of damage when they are used and the way they respond to treatment. The eight capability classes are designated by Roman Numerals I-VIII. Soils in Class I have few limitations, the widest range of use and the least risk of damage when they are used. Those in the other classes have progressively greater natural limitations. Soils in Class VIII are rough, shallow or otherwise limited so that they do not produce worthwhile yields of crops, forage or wood products. Table 9 summarizes the eight classes in the SCS agricultural capability system.

TABLE 9

AGRICULTURAL CAPABILITY CLASSIFICATION FOR SOILS

<u>Class</u>	<u>Description</u>
I	Soils have few limitations that restrict their use.
II	Soils that have some limitations that reduce the choice of plants that require moderate conservation practices.
III	Soils have severe limitations that reduce the choice of plants or that require special conservation practices or both.
IV	Soils that have very severe limitations that restrict the choice of plants, or that require very careful management or both.
V	Soils that are not likely to erode but have other limitations, impractical to remove, that restrict their use largely to pasture, woodland, or food and cover for wildlife.
VI	Soils that have severe limitations that make them generally unsuitable for cultivation and that restrict their use largely to pasture, range, woodland, or wildlife.
VII	Soils that have very severe limitations that make them generally unsuitable for cultivation and that restrict their use largely to grazing, woodland or wildlife.
VIII	Soils and landforms that have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or to esthetic purposes.

Source: General Soils Atlas for Planning Districts
III and IV, 1974.

For the purposes of broadly recognizing which areas of Alachua County exhibit various qualities or potential for agriculture the 18 soil types described in the general soil survey for Alachua County were divided into groups corresponding to the capability groupings of the Soil Conservation Service. Table 10 summarizes the general capability grouping of the soil types by number as they correspond to those soils on the general soils map of Alachua County.

TABLE 10
AGRICULTURAL CAPABILITY CLASSES OF SOILS
IN ALACHUA COUNTY .

<u>General Agricultural Capability Class</u>	<u>Soil Associations (From Table 4)</u>
I - II	4,5
III	2,3,7,8,9,13,14,17
IV-III	1,6,10,11,12,15,16,18

Source: Adapted from General Soils Atlas for Planning Districts III and IV, 1974.

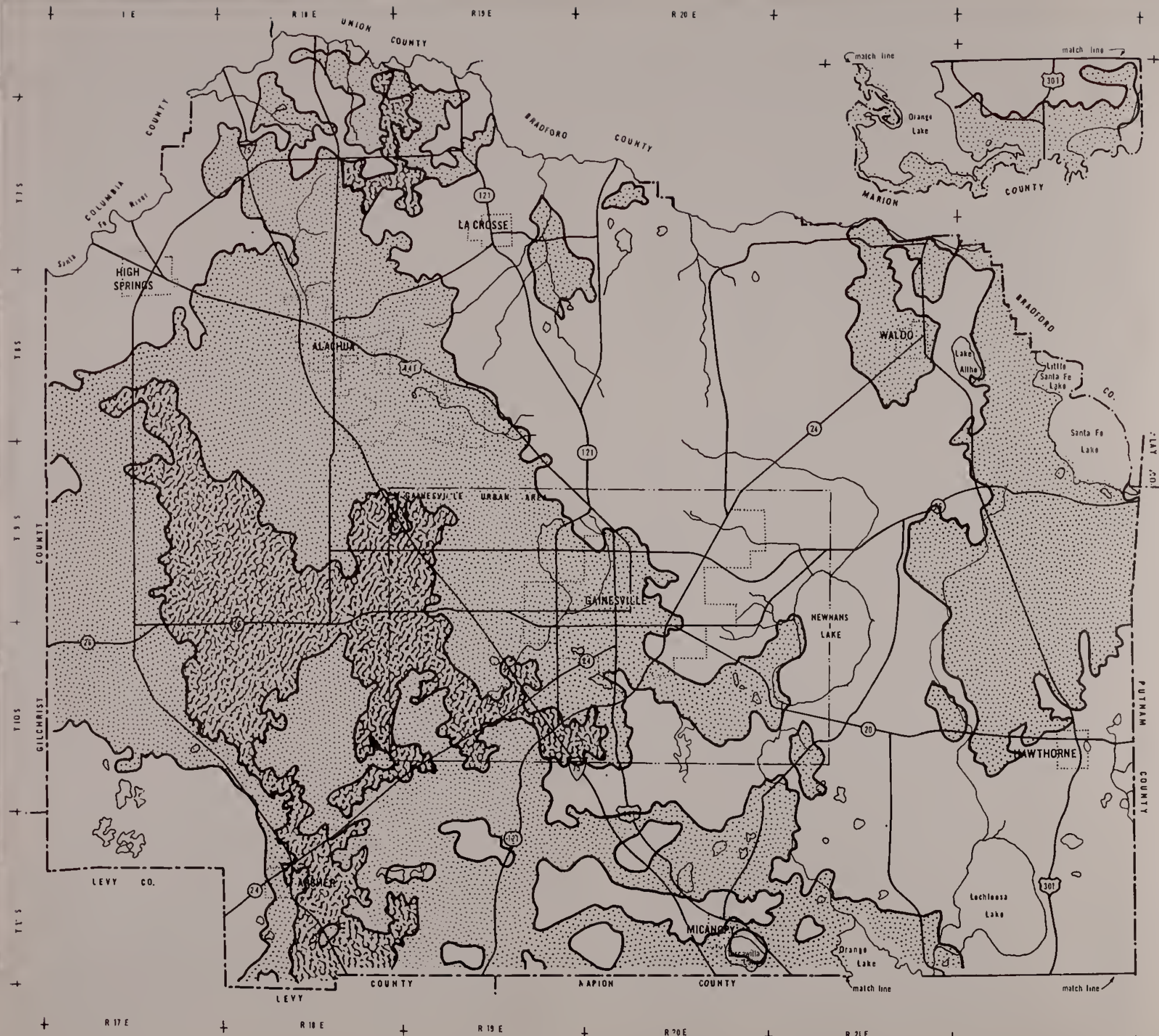
From this information Map #9 was prepared to illustrate those general areas of the County which, according to soil suitability, have the greatest and least potential for agricultural utilization.

In general, agriculture in Alachua County is essential to its economic well being and important to meet the growing demand for agricultural products. Although poor agricultural management practices can have serious effects upon surrounding

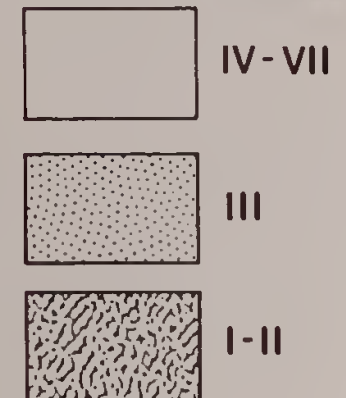
ecosystems as well as the agricultural land itself, the importance of sound management is recognized by the farmers of Alachua County and encouraged by the Office of the County Agricultural Agent.

In summary, it is essential that provisions be made and recognized for the maintenance of agricultural lands in Alachua County. Even though technology is progressing at a rapid rate to increase productivity from farm lands, the ever declining amounts of land for agriculture use in the County can more than offset technological improvements.

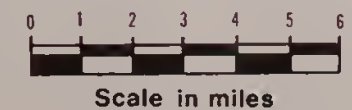
Map No. 9
**GENERAL AGRICULTURE
 SUITABILITY MAP**
 FOR
ALACHUA COUNTY
 FLORIDA



General Agricultural
 Capability Class



INCREASING
 SUITABILITY
 FOR
 AGRICULTURE

ecosystem
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In summary
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Forestry

General

In order to fully appreciate the need for conservation practices in forestry, it is necessary to conduct an appraisal of the condition and capability of that resource in terms of probable needs for future citizens. Factors of increasing population, a rising standard of living and the development of an even greater diversity of forest products are indicative of the great demand placed upon our current forest resources.

As evidenced by rapidly rising prices for forest products, the present level of forest productivity is inadequate to meet current demands. However, studies by the U.S. Forest Service illustrate that forest lands can be made to sustain much larger annual harvests than at present. It appears that the solution is not one primarily of providing more space, but of wise management of forest lands. At the present time only a relatively few foresters and private owners are actually supervising the maintenance of our forests during a period which could have significant national consequences.

Forestry in Alachua County

In the publication entitled, Timber for Tomorrow by the Florida Division of Forestry, general information on the forest resources of the state is presented on a regional basis. The region containing Alachua County is comprised of those counties within Planning District III and includes the counties of Alachua, Bradford, Clay, Union, Columbia, Gilchrist, Dixie, Lafayette, Taylor, Suwannee, Madison, Hamilton and Baker. Within this district, land ownership is dominated by the forest industry which owns 59% of all commercial forest land, followed by 18%

owned by farmers, 20% by other private ownerships, 2% in national forests and about 1% in public lands. Of the industry owned commercial lands, the pulp and paper companies own 89% and fairly well dominate the forest practices of the region. These land divisions compare rather consistently to Alachua County with some 311,000 total acres of forest land.

Because of the conflicting values of land use, such as those lands utilized for housing, public facilities and utilities, as well as pressures for additional lands for recreational use, the amount of land available for forestry as for other forms of agriculture is most to likely decrease in future years. And although some lands will undoubtedly revert to forestry use, such as agricultural lands which might be put to tree farming, it is not likely that minor land use changes will be significant and that commercial forestry practices will extend to poorer quality land. It is more likely that increasing trends for more intensive forest management will continue coupled with an overall gradual decline in area of commercial forest lands.

Over 60% of the commercial forest in the region consists of pine type forest. These lands are broken down as longleaf and slash pine forest approximately 50%, loblolly-short leaf pine forest approximately 4%, and oak-pine forest 10%. Approximately one quarter of the commercial forestry land is oak-gum-cypress forest and the remaining 13% in oak-hickory forest. This also compares consistently with forest types for Alachua County as indicated in Table 11.

TABLE 11
AREAS OF COMMERCIAL FOREST LAND
BY FOREST TYPE

ALACHUA COUNTY			REGION
Forest Type	Acreage	Percent Total	Percent Total
Slash-Long Leaf Pine	141,700	45.5	50
Loblolly-Short Leaf Pine	20,300	6.5	4
Oak-Pine	32,400	10.4	10
Oak-Hickory	74,400	23.8	25
Oak-Gum-Cypress	42,200	13.6	13

Source: Forest Statistics for Northeast Florida, 1970

The Division of Forestry reports that the forest industry and national forests maintain most of their land in softwood (primarily pine) forest while other private owners have more land in hardwoods than pine. This reflects at least on the part of the forest industry, an effort to convert land to pine forest crops. Such is the case in the majority of northern Florida where land owners favor pine over other species because of its relative hardiness, high fiber content, wide usefulness and ease of propagation.

Measures of Forest Quality

There are two parameters commonly employed as measures of forest quality. These are stocking class and site class ratings. These parameters are described as follows:

Growing stock trees are defined as living trees of any commercial species qualifying as desirable or acceptable trees. The amount of land well stocked with such trees is a good indicator of forest management practice.

Stocking values are usually expressed as a percentage and do not necessarily reflect an actual volume of timber. That is, the stocking standard is based upon the number of acceptable trees per acre by total numbers when under 5 inches in diameter. When over 5 inches in diameter, the minimum basal area is used and expressed in square inches to determine the percent stocking value. Values are determined by sampling a statistical number of trees occurring in each unit area meeting minimum standards. By awarding a number of stocking percentage points for each sample group evaluated, it is possible to exceed 100%. For example, the minimum number of seedlings per acre for full stocking would be 600 and for full stocking of an area of trees with a 10 inch diameter at breast height (D.B.H.) there would be 155 trees per acre with an average minimum basal area of 85 square inches.

Stocking percentages for the purposes of comparing forested areas are classified as follows:

Overstocked, greater than 130%	Medium stocked, 60-99%
Fully stocked, 100-130%	Poorly stocked, 16.7-59%
Understocked, less than 16.7%.	

The following table illustrates how Alachua County fares when forest management is judged by stocking percentages:

TABLE 12
AREA OF COMMERCIAL FOREST LAND
BY STOCKING CLASSES OF GROWING STOCK TREES

<u>Acreage</u>	<u>Stocking Percentage</u>
10,100	greater than 130
33,800	100 to 130
131,700	60 to 99
101,300	16.7 to 59
34,100	less than 16.7

311,000 Total Acres

Source: Forest Statistics for Northeast Florida, 1970.

The site class rating is a classification of forest land in terms of its inherent capacity to grow crops of industrial wood based on fully stocked natural stands. The rating is indicative of the ability of an area to produce a desirable rate of timber growth and is related to the value of land for forest purposes. The scale is listed as follows:

- Class 1 - Sites capable of producing 165 or more cubic feet per acre annually.
- Class 2 - Sites capable of producing 120 to 165 cubic feet per acre annually.
- Class 3 - Sites capable of producing 85 to 120 cubic feet per acre annually.
- Class 4 - Sites capable of producing 50 to 85 cubic feet per acre annually.
- Class 5 - Sites incapable of producing 50 cubic feet per acre annually by excluding unproductive sites.

Table 13 suggests that of the total 311,000 acres of commercial forest land in Alachua County only relatively few of these lands exhibit a really good natural environment for timber production.

TABLE 13
ARCES OF COMMERCIAL FOREST IN ALACHUA COUNTY
BY SITE CLASS RATING

<u>Class</u>	<u>Acreage</u>	<u>Percentage</u>
1	15,200	4.9
2	15,200	4.9
3	98,000	31.5
4	180,000	58.0
5	16,900	5.5

Source: Forest Statistics for Northeast Florida, 1970.

The previous two charts are self explanatory. They illustrate that while large areas of Alachua County are apparently well stocked and well managed, large acreages exist where there is a definite need for improvement.

Primary tree types harvested and utilized in the region include but are no means limited to the two principal classes of trees:

Soft Woods - Pine, Cypress, Cedar

Hard Woods - Red and White Oaks, Black Tupelo
and Sweet Gum, Bay and Magnolia, Ash, Elm,
Hackberry, Hard and Soft Maple, Hickory,
Bass Wood and others.

Appendix 2 has been included to illustrate the type and variety of trees and other natural vegetation found in North Central Florida, the majority of which have been identified in Alachua County.

There are 28 primary processing plants in this region. The three located in Alachua County consist of one saw mill, one veneer mill and one pole and post plant. No figures on industry usage are available for the County.

Forest Management

Conservation, as applied to forest resources, implies management by man to improve the quality of the forest and increase the potential harvest beyond what nature would do if left alone. The concept of sustained yield is basic to the conservation of forests. In the case of sustained yield, the harvest does not exceed the growth, however, the possible volume of annual harvest varies with the intensity of management from a minimum

of natural growth without any management to a maximum limited only by technical expertise and assistance in tree growing. Between the two extremes there lies an economical level of sustained yield for any forest site. The establishment of this optimal level of yield requires extensive work by professional foresters to carefully plan and maintain a long range program for forest management.

There are many sound practices that have been developed for the improved management and maintenance of timber lands. A few of the more common practices include thinning to reduce forest density, pruning lower limbs to reduce knots and upgrade the quality of logs, initiation of a selective logging or continuous harvesting system and many other methods by which experienced foresters can facilitate efficient forest management under any system of commercial forestry.

Problems which must be handled within the Alachua County area include forest regeneration which must occur where timber stocks have been seriously depleted, combating mortality of timber through fire, disease and weather, as well as new man-made dangers such as flooding, construction and lowering of the water table. Other problems include the taxation of forest lands, pollution and lesser problems concerning timber production.

Many of these problems are routinely handled through the office of the Alachua County Forester which is jointly sponsored by the Alachua County Board of County Commissioners and the Florida Department of Agriculture and Consumer Services. This office is staffed by trained foresters who will provide, upon request, limited consultation to private individuals as well as commercial forest industries. Other services provided to the County include forest fire fighting capabilities, public education through elementary school programs, seedling sales and other related activities.

Map Preparation

For the purposes of comparing forest resources to other natural resources of Alachua County, it was necessary to categorize forest and other vegetation types into six different groups. These categories were developed with the assistance of the County Forester and defined from a recent aerial photograph of Alachua County having a scale of one inch to one mile. Listed below are the vegetative categories selected for definition in order of increasing sensitivity to intensive land uses:

- 1) Non-forested lands
- 2) Agricultural and pasture lands
- 3) Pine lands
- 4) Upland hardwoods
- 5) Prairie
- 6) Lowland hardwoods

These vegetative types are presented for illustration and evaluation on Map #10. Their order of sensitivity to development was determined with the assistance of an Alachua County Forester.

Non-Forested

Agriculture and Pasture

Pinelands

Upland Hardwoods

Prairie

Lowland Hardwoods



Scale in miles

Map Preparation

For the purpose of
resources
forest and
These categories
Forester
County have
the vegetation
increasing

- 1) Non-forest
- 2) Agriculture
- 3) Pine
- 4) Upland
- 5) Prairie
- 6) Lowland

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WILDLIFE RESOURCES

Introduction

In the material economy of today's world, wildlife occupies only a small role, but is becoming increasingly important to the quality of life and enrichment of modern living. During the early years of this country, wildlife occupied an important position by providing commercial value as furs and a vital food supply. Today, however, wildlife constitutes a major foundation of the growing recreational industry and in a small way, is still important to the control of agricultural pests in addition to its high esthetic value.

Wildlife forms an essential element of outdoor recreation activities. The esthetic value of wildlife to an ever increasing number of individuals is almost beyond measure. In Florida, the wildlife community plays a major role in natural ecosystems and functions in many ways to maintain and insure the complexity and stability between the State's interacting natural systems. The loss of any species reduces the numbers and types of interactions which may occur in the normally diverse natural system and therefore may reduce the ecological value of that system. Valuable functions of the wildlife community, in addition to those mentioned including the redistribution and recycling of nutrients, their service as indicators of the general status of the environment and the aid they provide in the propagation of vegetation.

Wildlife Habitats and Importance

The wildlife of an area is dependent on many factors, vegetation being the most important. Each plant community has a

characteristic animal community, the combination of which is considered a biological community, and an ecosystem is simply defined as the biological community and its non-living environment. Biological communities are normally named for the more abundant or dominant species, usually a plant.

Among the general biological communities of Alachua County are included the following communities and some commonly associated animals. The swamp forest or lowland hardwood forest is normally found in Alachua County in areas such as the borders of the Santa Fe River and to a small degree Hogtown Creek. Common animals in this community include the otter, red shoulder hawk, barred owl, wood ducks, grey squirrel, a variety of passerine birds (most common yard birds) and many others. The biological community of the mixed hardwood and pine forest typically found in the western part of Alachua County contains such animal species as the white-tailed deer, gray and fox squirrel, several species of woodpeckers and the great horned owl. In the flatwoods or slash pine forest of northeastern Alachua County commonly found species include the cottontail rabbit, cotton rat, red-tailed hawk and the great horned owl. In freshwater swamps and prairies, typified by Paynes Prairie in south-central Alachua County, are found a number of animal species including the Florida roundtailed muskrat, egrets, heron and bitterns, the sandhill crane and a great variety of water fowl, including rails, coots, gallinules, marsh wrens and several other passerine species. Prairies and swamps also provide feeding grounds for many predators such as the bald eagle, osprey and marsh hawk.

The foregoing description is only a brief sampling of the variety wildlife species in the county. A complete list of terrestrial wildlife is quite lengthy; therefore, only a representative portion is provided in Appendix 3.

With increasing population and pollution, the spread of urban areas and ever increasing numbers of sportmen, the quality and quantity of wildlife appears to be diminishing due to the limitations imposed on their numbers and distribution. There is no doubt that wildlife resources must be an integral component in any resource and development project because wildlife is a fundamental part of the total natural environment.

There are three basic methods for maintaining wildlife populations. These include: 1) the preservation or improvement of wildlife habitat: 2) the regulation of harvest or complete protection through game laws and; 3) increasing wildlife stock by artificial means. Of these, the maintenance, development and preservation of habitats is probably the most efficient method to promote wildlife populations. In terms of private contribution to this effort the farmer plays a major role in provision of habitats as evidenced by the often great number of wildlife that find cover on farm areas.

Game regulations recognize that every habitat has a maximum capacity; and when that capacity for a certain game species is overtaxed by too large a population, the habitat is damaged by over grazing and the population starves. Therefore hunting and fishing must be based on orderly harvest methods which must not take place in excess of the biological minimum limits which would insure repopulation by that species.

Each of these methods, as well as others, are employed by the Florida Game and Freshwater Fish Commission in managing the State's wildlife resources. Work conducted by this agency includes the study of wildlife populations, such as on Paynes Prairie, the supervision of wildlife management areas and game law enforcement.

Determination of Habitat Suitability

In Alachua County there is a need for a wildlife suitability map describing those areas which have a high potential or suitability for wildlife populations. In the absence of other available information, it became necessary to prepare a map based upon a combination of three of the more important factors which determine the habitat suitability for wildlife, i.e., vegetation, soils and land use.

In a general sense, vegetation greatly influences the distribution of wildlife by controlling the type of food present, and the availability of suitable cover in a natural environment. Vegetation groups previously defined were subjectively placed in order of their suitability for wildlife according to their extent and value in Alachua County by a wildlife biologist of the Game and Freshwater Fish Commission. A map was then prepared showing wildlife suitability in terms of vegetation.

Utilizing the capability interpretations provided by the U.S. Soil Conservation Service, it was possible to combine the soil types defined in the general soils map of Alachua County into six broad categories determined by the suitability of each to support wildlife. Because soils directly influence the kinds and amount of vegetation and available water, they indirectly influence the kinds of wildlife that live in an area and therefore are equally important in determining what types of habitat or suitability an area may provide for wildlife. A second map was then prepared on wildlife suitability in terms of soils.

The third factor to be considered in determining habitat suitability for wildlife was intensity of land use. Because certain land uses greatly restrict the number and type of animals

that may inhabit an area, they are an important element in habitat considerations. Land uses were drawn from the existing general land use map of Alachua County and modified with recent aerial photographs. Land uses were divided into three broad categories. These include undeveloped/vacant land, intermediate land uses including agriculture, pasture and tree farms, and lastly urban/developed areas.

Each of the three maps was prepared on transparent acetate using different grades or intensities of patterns corresponding to the relative wildlife value of each map element. In this scheme, areas best suited to wildlife were awarded the darkest shades and the most poorly suited, the lightest grades. By superimposing each of these three acetate maps it was possible to prepare a composite wildlife suitability map for Alachua County. The value scheme utilized in map preparation is shown in Table 14 below:

TABLE 14

COMPONENTS OF THE GENERAL WILDLIFE SUITABILITY MAP*

Vegetation	Soils (from the soils Atlas for Planning Districts III & IV)	Land Use
1. Prairie	1. 14	1. Rural/Undeveloped
2. Lowland hardwoods	2. 4, 9, 11, 13, 18	2. Intermediate Land
3. Upland or mixed hardwoods	3. 2, 5, 7, 15, 16	3. Urban/Developed
4. Agriculture, Pasture, Pinelands	4. 1, 3, 8, 12, 17	
5. Non-forested	5. 6, 10	

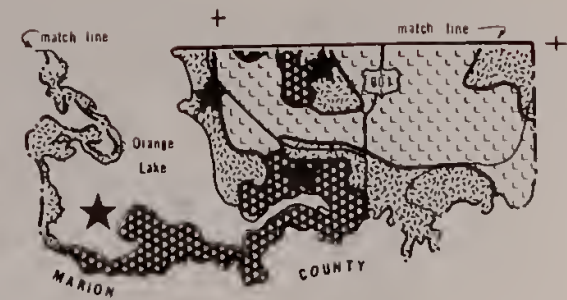
*In order of most suitable to least suitable in terms of wildlife.

The composite map, noted as Map #11 in the text, generally defines those areas which by virtue of their vegetation, soils and existing land use would favor or restrict the suitability of an area for wildlife. The areas which show the least suitability for wildlife habitat certainly do not imply that those areas are barren of wildlife but only indicate that a limited number or certain type of species may successfully utilize those areas as habitat.

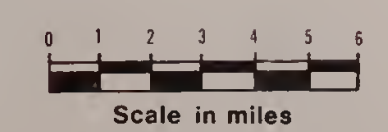
It should also be noted that many small pockets of land with high or low habitat values are scattered throughout the county. Due to their influence on diversity, or "edge effect," these small areas of habitat have a value above their intrinsic scaled value and should be considered of maximum importance to the total area of habitat in which they occur.

In addition, limitation of scale and the generality to which the data available allows maps to be presented restricts the detail to which suitable wildlife habitat areas may be defined. Therefore, the map should not be construed to be all inclusive but only broadly defines those areas of optimum wildlife suitability. Smaller areas not identified on this general wildlife suitability map are awarded consideration in the map and text defining significant natural areas. They are thereby incorporated into the total natural resources picture of the county and included into the composite map of natural systems identified as Map #14 in the text.

Map No.11
**GENERAL WILDLIFE
 SUITABILITY MAP**
 FOR
ALACHUA COUNTY
 FLORIDA



★ Threatened Species or Unique Habitat



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AREAS OF ENVIRONMENTAL CONCERN

Introduction

Many kinds of natural areas perform valuable functions essential to the environmental quality of the County. Such functions include aquifer recharge areas, biologically active wetlands, forests, flood plain areas and buffer or green belt areas around urban centers. The preservation and conservation of such areas is highly important to the land use planning program and warrants attention in an accounting of natural resources.

Preservation and Conservation Programs

The Florida Legislature has been progressive in recent years and as a result of certain legislation, i.e., the Land Conservation Act of 1972 and the Florida Environmental Land and Water Management Act of 1972, the State is able to acquire and/or require management provisions for valuable natural lands for the citizens of Florida. The Florida Environmental Land and Water Management Act permits the Governor and his Cabinet to designate geographical areas having significant environmental, historical, natural or archeological resources of regional or state-wide importance as Areas of Critical State Concern. This designation does not diminish private property rights but does enable local governments or other governmental agencies having jurisdiction to write land development regulations for each designated area and to implement the established land development principals as outlined.

The Land Conservation Act of 1972 was designed to conserve and protect environmentally unique and irreplaceable lands which are valued ecological resources to the state. A bond program of \$240 million authorizes the purchase of such lands.

Of these two programs only the Land Conservation Act has been successfully used in Alachua County to acquire valuable natural areas, i.e., San Felasco Hammock and the McLeod Ranch or Oleno Addition. The citizens of Alachua County are extremely fortunate not only to have had the state previously acquire valuable natural lands in the form of Paynes Prairie and the various University holdings but to have had other important open space areas acquired that are equally valuable to the County.

However, there are many other areas that because of their size, potential cost, location, etc., do not qualify for purchase or designation as an Area of Critical State Concern. Indeed it is impossible and undesirable for the State to acquire or manage all those open spaces or desirable environmentally valuable lands within the County.

The Division of State Planning is currently engaged in a project known as the Florida Green Plan. This agency recognized that although a need exists to conserve valuable open spaces, it is impossible for the state to acquire all desired lands. Therefore, as a first step toward devising methods whereby local and state governments could regulate and guide the development of these scenic and environmentally important areas, the Division is engaged in a program to inventory and map all such areas already recognized within the State. Through Council participation in this activity, well over 100 areas in Alachua County have been identified. A number of these areas are noted on Map #12 which shows the general location of major sites acquired by the State in addition to other areas considered valuable for their recreational, archeological or natural attributes. This map provides an important contribution to the composite map of natural resources by insuring recognition of some areas which might otherwise have been neglected or overlooked on individual resource maps.

In addition to that legislation already mentioned, investigation indicates that there are a variety of State and federal programs which provide for the acquisition or protection of environmentally valuable land. It is anticipated that efforts will be made to have some of the areas noted herein and similar areas preserved in their natural state. Therefore, a synopsis of those programs identified to date is as follows:

- * The Florida Natural Features Program, sponsored through the Department of Natural Resources, Division of Recreation and Parks is a newly instigated program designed to give recognition through registration of the important and unique natural features found throughout the state. By such registration, preservation by owners will be encouraged; however, the preservation of privately owned features identified is not guaranteed or enforceable.
- * The Federal Wild and Scenic River Act (PL 90-542) provides for federal right-of-way acquisition of rivers which are nationally recognized as having unique wild and scenic characteristics.
- * The Wildlife Management Area Program is sponsored by the Florida Game and Freshwater Fish Commission. Under this program large property owners may lease approved lands for wildlife propagation and hunting management to the Game and Freshwater Fish Commission at a nominal cost per acre per year. This program allows the Commission to regulate hunting practices and foster good game management upon regulated land but in no way restricts the owner from utilizing those lands.
- * The recently enacted "Green Belt Law" (Florida Chapter 72-181, Laws of Florida) allows municipal and county government to

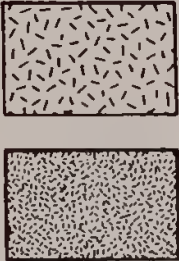
offer tax incentives as a mechanism for encouraging retention of privately owned parks and recreation areas as well as for leaving forestry and game management areas in an undeveloped condition.

- * Chapter 72-309, Laws of Florida allows the State to lease privately owned lands for at least 50 years for inclusion into the Florida Wilderness System. In addition to providing tax relief of those lands, it provides on other means of protection for areas set aside specifically for the protection of wildlife.
- * Protective zoning ordinances such as the Scenic River Ordinance recently prepared to allow the Columbia County Commission to regulate the development along the Suwannee River can be developed by any county to suit its specific requirements. Such an ordinance could be an extremely valuable tool in protecting or conserving the natural resources of locally recognized environmentally valuable lands.

The reader is referred to the following reports for a more thorough documentation of areas in Alachua County having environmental, historical or archeological value:

- 1) Open Space and Recreation Study; North Central Florida Regional Planning Council; 1972.
- 2) Areas of Environmental Concern in Planning District III; North Central Florida Regional Planning Council; 1973.
- 3) Florida Green Plan Site Inventory; a working notebook of natural, archeological and historical sites maintained by the North Central Florida Regional Planning Council.

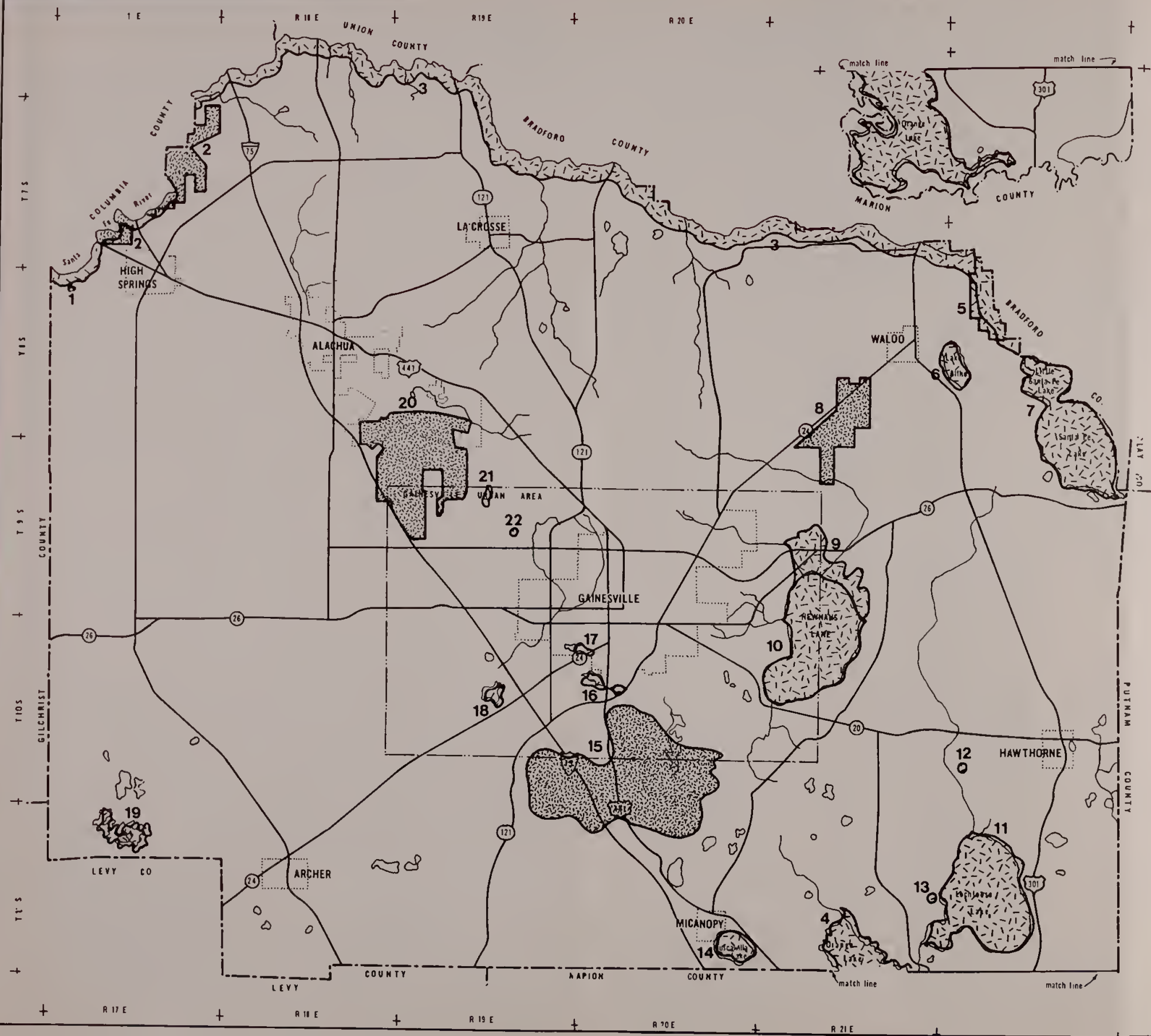
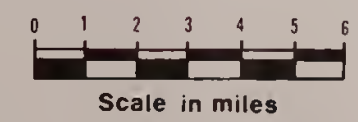
Map No.12
**SIGNIFICANT NATURAL
 AREAS MAP**
 IN
ALACHUA COUNTY
 FLORIDA



SIGNIFICANT AREAS

STATE OWNED SIGNIFICANT AREAS

- | | |
|-------------------------------|----------------------------|
| 1 Poe Springs | 11 Lockloosa Lake |
| 2 McLeod Ranch | 12 Magnesia Springs |
| 3 Santa Fe River | 13 Little Garrison Hammock |
| 4 Orange Lake | 14 Tusawilla Lake |
| 5 Santa Fe Swamp | 15 Paynes Prairie |
| 6 Lake Altho | 16 Bivens Arm |
| 7 Santa Fe Lake | 17 Lake Alice |
| 8 Austin Cary Memorial Forest | 18 Lake Kanapaha |
| 9 Gum Root Swamp | 19 Watermelon Pond |
| 10 Newmans Lake | 20 San Felasco Hammock |
| | 21 Fox Pond |
| | 22 Devila Millhopper |



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EXISTING LAND USE

It is evident that the intensity to which man modifies or utilizes the land and its resources affects the integrity of almost every natural system in and around that land. Therefore, how the land is utilized determines to a large extent the viability of natural systems which exist in any area. Because this viability usually depends upon the intensity of the activity, a map was prepared for this report representing broad intensities of existing land uses.

Intensity of land use is related to all other natural resources by limiting or modifying their occurrence or accessibility. Therefore, an existing land use map was made illustrating existing manmade systems in order that this concept could be incorporated into the composite map. This was accomplished to realistically assess the impact of human modifications to the land in the overall sense of natural system potentials.

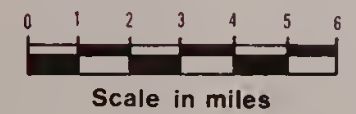
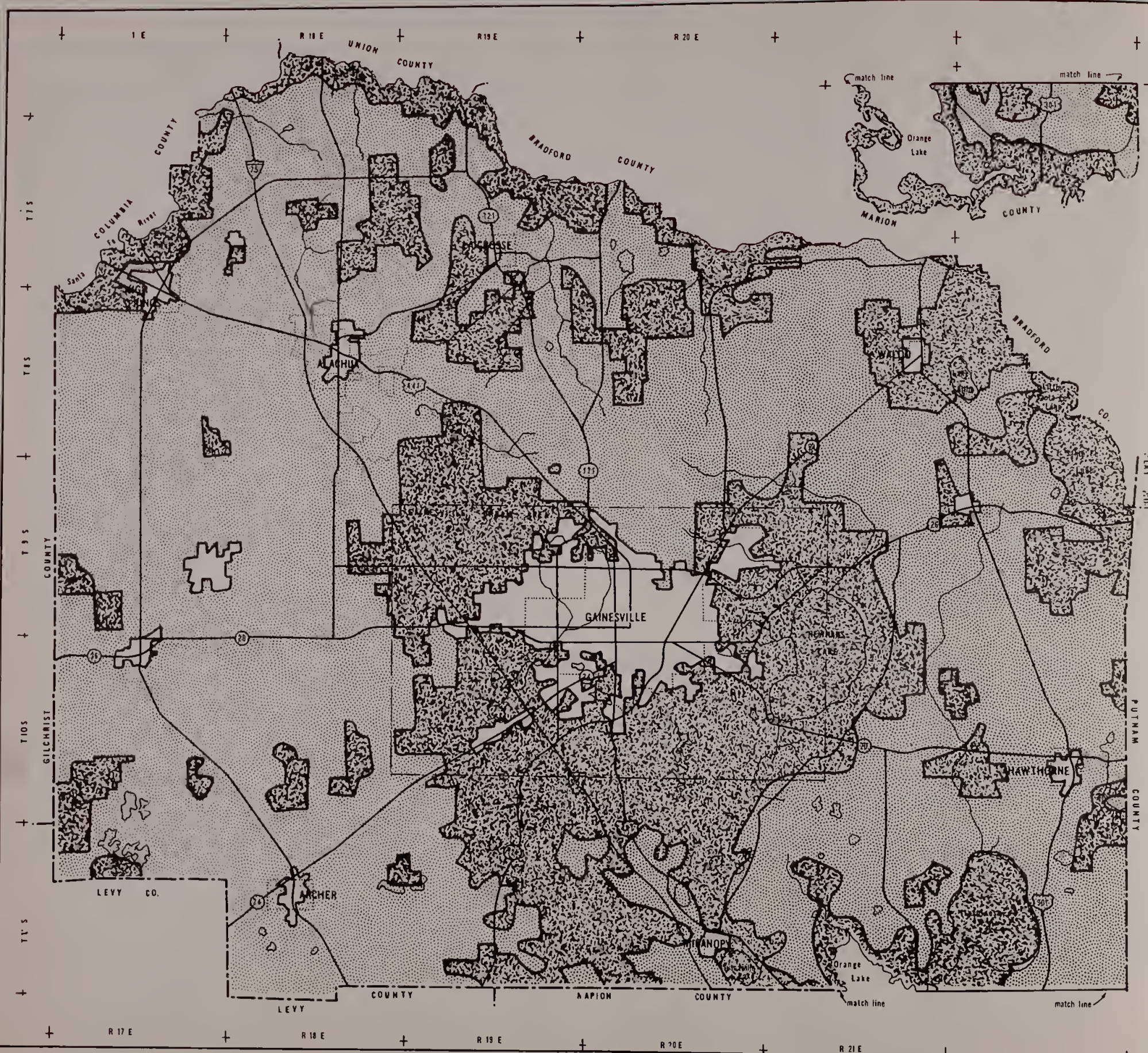
Map #13 in the text, which illustrates relative intensities of land use, was prepared utilizing the land use map found in the Preliminary Plan prepared by the North Central Florida Regional Planning Council in 1972. Table 15 below illustrates the broad categories of intensity utilized in the map and notes the corresponding specific land use which was included in each category. The direction of increasing intensity of land use indicated in Table 15 may also be interpreted as indicating most-sensitive to least-sensitive areas. In this case urban/developed land uses are considered least sensitive to further growth and development from a natural resources standpoint and rural/developed lands most sensitive.

TABLE 15
Land Use - Intensity Comparison

<u>Relative Intensity</u>	<u>Land Use</u>
Least Intensive	Rural/Undeveloped, (limited use activities,) eg: recreation, forestry, swamp.
Intermediate	Ex: Agriculture/pasture
Intensive	Urban/Developed, eg., residential, commercial, institutional, transportation, communication, utilities, industrial and mining.

For the purposes of this report, the map illustrating existing land uses was updated with information that was readily available and which included recent aerial photographs of Alachua County. This map is utilized as an integral component in evaluating the combined interactions between natural systems as represented in the final or summary map, noted as Map #14 in the text.

Map No.13
EXISTING LAND USE
MAP
 FOR
ALACHUA COUNTY
 FLORIDA



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COMPARISON OF NATURAL SYSTEMS

Methodology

From a comparison of the general maps contained in this study, certain interrelationships become visually apparent. Many of these are key relationships and are very important to land use planning because they illustrate the interdependence of natural systems, identify points of friction between natural and man-made systems and help to lend a better perspective of the value these systems contribute to defining quality of life. Many relationships may be observed from the maps included with this text; however, for the purpose of illustration only a few of the more important comparisons are noted as follows:

1. **Geology/Recharge Maps:** From this comparison it may be seen that the southwest portion of the County, where the Ocala Group of limestones are very near the surface, is the area of highest groundwater recharge in the County. Because of the high potential for recharge and economic importance of this resource to Alachua County (in addition to the limitations such limestone occurrences often pose to development), the Ocala Group of limestones is noted as having the highest sensitivity on both maps. The coding used on the recharge map is not intended to indicate that no recharge takes place in those areas of the County underlain by the Hawthorne formation. However, due to the nature of this formation, except for a few areas typified by solution features such as the Devil's Millhopper, recharge contributed through this formation is very minor.

2. Recharge/Wetlands Maps: Only a very few of the major wetland areas are within or adjacent to the major recharge areas. Coupled with topographic considerations, it may be observed that while runoff from relatively impermeable areas of the County is partially channeled through natural waterways toward areas which readily recharge the Floridan aquifer, a great deal of runoff is channeled away from recharge areas and out of the County. This suggests that, should it be necessary or desirable, recharge areas of the County could be better utilized to achieve greater recharge potential if the demands for water resources throughout the region or State significantly increase in future years.

3. Soils/Agriculture Maps: The general soils map suggests development might best take place over large areas in the western portion of Alachua County. However, the soils with the highest potential for agriculture (as well as recharge potential) also lie within that area. Because of the value and importance of agriculture not only to the economy of this County, but also to the nation, the cost of development on prime agricultural land would appear to far outweigh many soil suitability considerations. Therefore, perhaps planning agencies should place greater emphasis on directing development toward areas other than those having high suitability for agriculture.

Composite Map

One of the primary objectives of this report is to compare and evaluate the interactions between, or sum total of, the more important natural resources and environmental systems within Alachua County. As described in the introduction, a modified

"McHarg" method of superimposing clear acetate overlays is employed to produce a composite map of natural resources. This composite is noted as Map #14 in the text. Those individual maps found in the text and utilized for the composite map include: geology, recharge, soil suitability for community development, soil suitability for agriculture, wetlands, vegetation, wildlife, land use and significant natural areas. By virtue of the varying pattern intensities on each of these individual maps, six groups of pattern intensities, are readily distinguished on the overlay composite.

Those few areas which due to shading cannot be readily assigned to one of the six groups have been examined to determine the specific factors or resources significant in each area. The area was then grouped with the darker or lighter shade composite pattern depending upon a subjective value judgement of the relative importance of the specific resources interacting on that portion of the composite map.

The six patterns represented on the composite map illustrate, by increasing pattern density, those areas which have increasing relative limitations to development. This comparison is relative only to those limitations imposed by natural systems and does not include considerations for such things as the availability of public utilities, transportation networks or similar manmade modifications of the environment.

The darkest patterns represent areas which might best be considered preservation areas in the interest of maintaining the best long-term environmental conditions. Intermediate shaded

areas suggest these natural areas which might best be served by a conservation approach to land use planning and regulation.

The lightest areas do not imply that there are no environmental considerations to be made in such areas. They simply suggest that (due to the relatively high degree of existing manmade modifications, such as urban or industrial development) natural systems are not generally as sensitive to change. There may, however, be important environmental considerations in lightly shaded areas as exemplified by those beneficial attributes of natural systems discussed in the chapter on climate.

The composite map does not show where development may take place in the County. Modern technology and building techniques could place development almost anywhere. However, the composite map can be considered a general guide for broad land use planning to show where development would have the least impact on natural systems.

The lakes and streams of the County have all been defined in a manner consistent with the methodology employed for land areas. It is noted, however, that because of their intrinsic nature, aesthetic and recreational attributes, planning for development on or within their immediate vicinity must involve a great deal more consideration than their pattern intensity might suggest. In addition, the reader is referred to the report entitled Environmentally Sensitive Areas - 1975, prepared by the Gainesville Department of Community Development prior to formulating specific assumptions on areas within the Gainesville Urban Area.

Urban Fringe Considerations

Certain problems or issues take on special significance when natural resource or other considerations transcend political boundaries. The information presented in this study identifies some old and well known issues as well as some new or potential considerations which will require the combined attention and cooperation between several local governments.

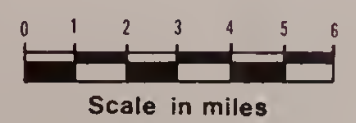
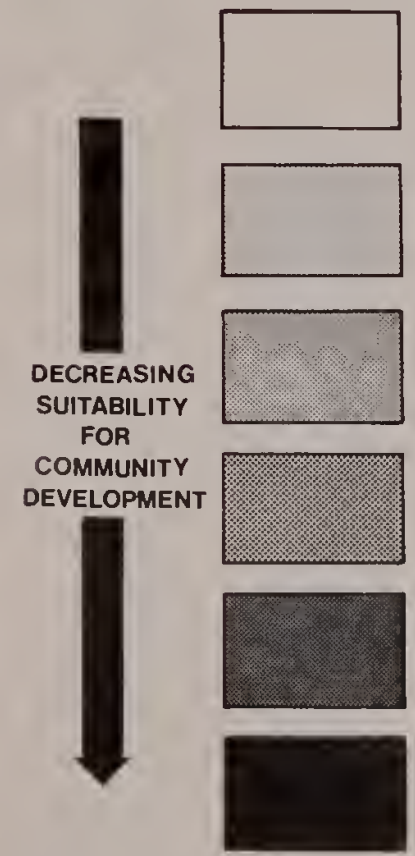
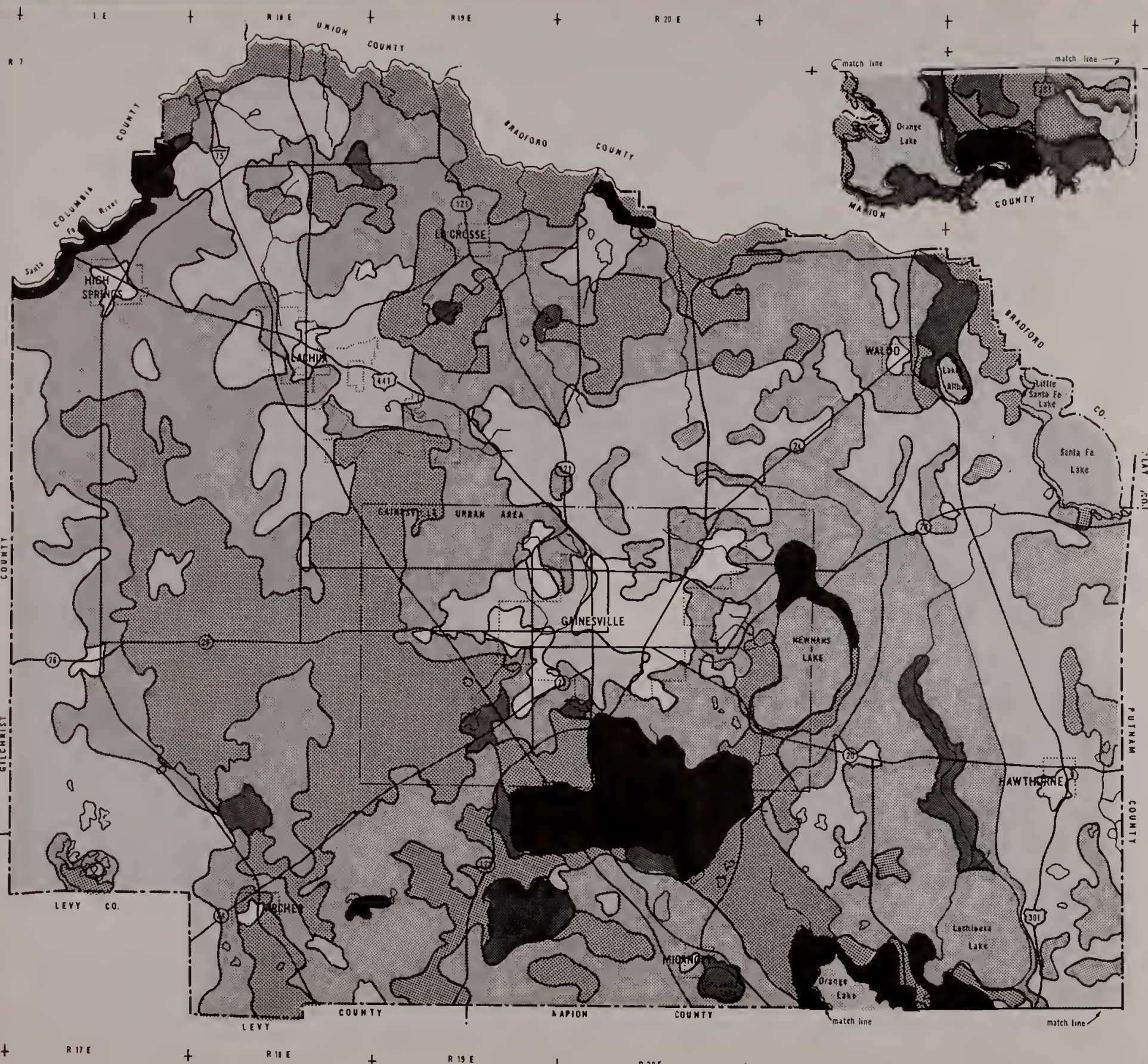
Potential issues common to adjacent governmental jurisdictions in Alachua County will certainly include the uses of natural resources. Cooperation will be required to ascertain their use, potential impacts, economics, and to settle the greatly differing value assessments of each resource. Of particular concern may be the use and disposition of lands suitable for phosphate mining. Similar needs for land use decisions may occur in and around areas of high environmental value. For example, the City of Alachua has recently annexed lands in and adjacent to the San Felasco Hammock, i.e. land purchased by the State under the Environmentally Endangered Lands program; also a similar situation is the question of management of lands in and around Newnan's Lake and Paynes Prairie.

General problems common to the County in general, and specifically to its municipalities, include the loss due to suburban growth of green or open space areas as natural buffer zones, historically a visual resource to the community. A consideration closely associated with this problem, and particularly indigenous to the cities of Alachua and Gainesville, concerns the direction and pattern of growth and the suitability of this growth with respect to the best long term utilization of the environment

and natural resources otherwise offered in developing lands.

A final issue which is readily apparent from the study concerns the establishment of land uses which are not only responsive to the viability and greatest optimization afforded by natural resources but also which pay due regard to the rights of land owners. This very complex problem will necessarily be an integral element in land use planning activities and is to include natural resources as an essential consideration.

Map No.14
COMPOSITE MAP
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NATURAL RESOURCES
 FOR
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CONCLUSIONS

Based on the information presented in this report, it is apparent that all natural resource elements should be considered together because they constitute a system of interdependent processes. Each of these defined elements is affected by the others and in turn is affected by human activities. The cause and effect relationship of these systems is far more complex than any individual map suggests. Therefore, planners and governmental officials will undoubtedly need the continued assistance of specialists in a variety of fields to evaluate the advantages and disadvantages of specific plans and proposals.

However, the system of map comparisons utilized in this study appears to be one viable method of summarizing natural resources data despite the limitations imposed by utilizing subjective value judgments for map preparation. The continued collection of data and revision of these general maps constitutes a useful methodology for establishing general patterns of resource values and relationships. Through this method then, one tool is established by which the limits and distribution of future growth may be better evaluated and planned. This and similar documents may be utilized by decision makers and planners to continually assess the trade-offs between growth and development versus quality of life in order to insure that future development is not only commensurate with environmental needs but also in the best long term interest of County citizens. A number of general conclusions may be reached which generally reflect a need for and degree of sophistication in natural resource considerations for local and regional planning efforts. The following

observations therefore are important in that from them the reader may extrapolate and innovate guidelines implied from this report and put the information presented to use through any number of planning perspectives.

Areas of relatively high sensitivity to development are vulnerable to abusive uses of surrounding land as well as direct developmental impact. As evidenced in part by isolated sensitive "islands" of valuable wildlife habitat, long term impacts affected by seemingly very low density developments may have, through time, substantial long term environmental repercussions. Therefore, potential indirect environmental impacts must be adequately addressed during development review and future land use planning activities.

The high natural values of wetlands as described in this report are not usually respected during development considerations, nor is their potential fully utilized in development practices. The need for further development policies by all local governments is therefore suggested not only for wetlands but also for other poorly drained areas within the County. Similarly, developments in and around areas of environmental concern, such as San Felasco Hammock or Paynes Prairie, need to be thoroughly evaluated in order to insure that long term environmental deterioration does not occur. A consideration of the possible useful employment of wetlands and other valuable natural areas for human purposes would be a useful consideration in long range land use planning for Alachua County.

Land use implications of natural resources as suggested by this study are so varied and complex that this study cannot be considered the end product of a natural resources survey.

It constitutes only a portion of the total work effort toward realizing and planning for the full and beneficial use of these resources.

Undoubtedly new information on natural resources in the future, in particular from the soil survey currently underway, will provide data which will alter, at least to some degree, the implications of the maps presented herein. Such revision is in the best interest of the community and should be encouraged as new information is available. In essence, however, it is important to acknowledge that the interrelationships as expressed or implied in the text do exist, and because of their far reaching consequences, they must play a key role in development decisions if natural systems are to continue to effectively function in our environment.

Therefore, the individual elements of this environmental inventory continually need to be combined, not only with one another, but also with information on land use, economics, transportation, population, housing and many other items for use in preparing comprehensive land use plans and for formulating decisions concerning specific projects and programs.

APPENDIX 1

Excerpt from the Rules of the Dept. of Air and Water Pollution Control, Chapter 17-3

17-3,09 Criteria; Class III Waters - Recreation - Propogation and Management of Fish and Wildlife

The following criteria are for classification of waters to be used for recreational purposes, including such body contact activities as swimming and water skiing; and for the maintenance of a well-balanced fish and wildlife population. All coastal and beach waters, including off-shore waters, not otherwise classified shall be classified as Class III; however, waters of the open ocean shall be maintained at a dissolved oxygen of not less than five (5.0) ppm. Streams specifically listed in Section 17:3.21 by a separate listing designated as "Special Stream Classification" shall similarly be maintained at a minimum dissolved oxygen of five (5.0) ppm.

(1) Sewage, industrial wastes, or other wastes - any industrial wastes, or other wastes shall be effectively treated by the latest modern technological advances as approved by the regulatory agency.

(2) pH - of receiving waters shall not be caused to vary more than one (1.0) unit above or below normal pH of the waters; and lower value shall be not less than (6.0), and upper value not more than eight and one-half (8.5). In cases where pH may be, due to natural background or causes outside limits stated above, approval of the regulatory agency shall be secured prior to introducing such material in waters of the state.

(3) Dissolved Oxygen - shall not be artificially depressed below the values of four (4.0) ppm (unless background information available to the regulatory agency indicates prior existence under unpolluted conditions of lower values). In such cases, lower limits may be utilized after approval by the regulatory authority.

(4) Bacteriological - coliform group not to exceed 1,000 per 100 as a monthly average, (either MPN or MF counts); nor to exceed this number in more than 20% of the samples examined during any month; nor exceed 2,400 per 100 ml (MPN or MF count) on any day. This criteria shall apply only to waters used for body contact activities.

(5) Toxic substances - free from substances attributable to municipal, industrial, agricultural or other discharges in concentrations or combinations which are toxic or harmful to humans, animal or aquatic life.

(6) Deleterious - free from materials attributable to municipal, industrial, agricultural, or other discharges producing color, odor or other conditions in such degree as to create a nuisance.

(7) Turbidity - shall not exceed fifty (50) Jackson units as related to standard candle turbidimeter above background.

(8) Temperature - shall not be increased so as to cause any damage or harm to the aquatic life or vegetation of the receiving waters or interfere with any beneficial use assigned to such waters.

General Authority 403.061 FS. Law Implemented 403.021, 403.031, 403.061, 403.101 FS. History - Amended 3-21-68, 1-17-69.

APPENDIX 2
A REPRESENTATIVE LIST OF VEGETATION IN
NORTH CENTRAL FLORIDA

FERNS AND FERN ALLIES

COMMON NAME

Ebony Spleenwort
Lady Fern
Mosquito Fern
Holly Fern
Florida Shield Fern
Dimorphic Chain Fern
Clubmoss
Boston Fern
Cinnamon Fern
Royal Fern
Resurrection Fern
Bracken Fern
Ladder-brake Fern
Water Spangles
Spikemoss
Wood Fern
Chain Fern

VINES

COMMON NAME

Pepper Vine
Cross Vine
Supplejack, Rattan Vine
Cat-claw Vine
Trumpet Vine
Dodder
Wild Hydrangea
Wild Yam
Yellow Jessamine
Japanese Honeysuckle
Coral Honeysuckle
Climbing Hemp Vine
Virginia Creeper
Maypops
Kudzu Vine
Poison-ivy
Cherokee Rose

VINES contd.

Greenbrier
Catbrier
Bamboo-brier
Wild Sarsaparilla
Summer Grape
Muscadine
Frost Grape
Wisteria

TREES AND SHRUBS

COMMON NAME

Box Elder
Florida Maple
Red Maple
Red Buckeye
Mimosa
Tung
Lead-plant
Devil's Walking Stick
Red Chokeberry
Pawpaw
Black Mangrove
False Willow
Saltbush
Leconte's False Indigo
Tarflower
River Birch
Sea Ox-eye
False Buckhorn
Tough Bumelia
French Mulberry
American Hornbeam
Pignut Hickory
Mockernut Hickory
Coastal Chinquapin
Casuarine, Australian Pine
Catalpa
New Jersey Tea

TREES AND SHRUBS contd.

Sugarberry
Buttonbush
Rosemary
Redbud, Judas Tree
Fringe Tree
Gopher Apple
Camphor Tree
Wild Orange
Flowering Dogwood
Florida Dogwood
Parsley Haw
One-flowered Haw
Little-leaf Titi
Persimmon
Hearts-a-busting
White Ash
Carolina Ash
Dwarf Huckleberry
Tangleberry
Loblolly Bay
St. John's Wort
Large Gallberry
Inkberry
Holly
Yaupon
Virginia Willow
March Elder
Southern Red Cedar
White Mangrove
Lantana
Fetter-bush
Sweetgum
Christmas Berry
Staggerbush
Bull Bay
Sweet Bay
China-berry
Red Mulberry
Wax Myrtle
Ogeechee Tupelo
Black Tupelo
Prickly Pear Cactus
Wild Olive
Hophornbeam
Redbay
Swampbay
Mistletoe

TREES AND SHRUBS contd.

Sand Pine
Slash Pine
Spruce Pine
Longleaf Pine
Loblolly Pine
Planer-tree
Sycamore
Chickasaw Plum
Cherry Laurel
Black Cherry
Chapman Oak
Southern Red Oak
Sand-live Oak
Bluejack Oak
Turkey Oak
Laurel Oak
Over-cup Oak
Sand Post Oak
Swamp Chestnut Oak
Dwarf Live Oak
Myrtle Oak
Water Oak
Running Oak
Shumard Oak
Live Oak
Red Mangrove
Wild Azalea
Winged Sumac
Poison Sumac
Poison Oak
Black Locust
Blackberry
Little Blue Stem Palm
Cabbage Palm
Coastal Plain Willow
Elderberry
Florida Soapberry
Sassafras
Saw Palmetto Palm
Teaweed
Storax
Sweet Leaf
Pond Cypress
Bald Cypress
Basswood
Winged Elm
American Fl

TREES AND SHRUBS contd.

Tree Sparkleberry
Florida Deerberry
Blueberry
Possum-haw Viburnum
Walter Viburnum
Rusty Black-haw
Spanish Dagger
Coontie
Toothache Tree
Magnolia
Witch-hazel
Black Cherry
Hurcules Club
Tulip Tree
Gallberry

HERBS

COMMON NAME
Shy-leaves
Yellow Colicroot
White Colicroot
Wild Onion
Alligator Weed
Pigweed
Thorny Pigweed
Ragweed
Broomsedge
Marsh Parsley
White Prickly Poppy
Yellow Prickly Poppy
Green Dragon
Jack-in-the-pulpit
Wire Grass
Switch Cane
Milkweed
Butterfly Weed
False-foxglove
False Indigo
Begonia
Green-eyes
Spanish Neddles
Rayless Goldenrod
False Nettle
Spiderlings

HERBS contd.

Fanwort
Indian Plantain
Sea-rocket
Grass-pink Orchid
Wine Cups
Baybean
Canna
Shepherd's Purse
Bitter-cress
Sedge
Partridge Pea
Sicklepod
Sand-spur
Butterfly Pea
Mouse-eared Chickweed
Cootail
Wild Chervil
Sun-bonnets
Lamb's Quarters
Water Hemlock
Horrid Thistle
Thistle
Saw-grass
Virgin's Bower
Butterfly Pea
Treadsoftly
Dayflower
Horseweed
Rabbit Bells
Rattle Box
Croton
Milkweed Vine
Sedge
Tansy Mustard
Tick Clover
Begger's Ticks
White-top Sedge
Buttonweed
Salt Grass
Sundew
Water Hyacinth
Spike-rush
Elephant's Foot
Green Fly Orchid
Fireweed
Daisy Fleabane

HERBS contd.

Bog Button
Wild Buckwheat
Button Snakeroot
Cherokee Bean
Dog Fennel
Mistflower
Dog Fennel
Spurge
Cottonweed
Indian Blankets
Milk-pea
Bedstraw
Cranesbill
Standing-cypress
Rabbit Tobacco
Bachelor's Button
Hedge Hyssop
Bitter Weed
Sneeze-weed
Rockrose
Sunflower
Coast Sunflower
Heliotrope
Silver Sword
Wooly Golden Aster
Camphor Plant
Rose Mallow
Hawkweed
Fairy Footprints
Marsh Pennywort
St. John's Wort
Pinweed, Orange Glass
Dwarf St. John's Wort
Yellow Star Grass
Morning Glory
Scarlet Morning Glory
Man-of-the-earth
Railroad Vine
Cypress Vine
Wild Iris
Rush
Black Rush
Seashore Mallow
Dwarf Dandelion
Redroot
Wild Lettuce
Henbit

HERBS contd.

Pepper Grass
Pin Weed
Duckweed
Bush-clover
Blazing Star
Frog's-bit
Sea Lavender
Toad-flax
Match-heads
Flowering Straws
Loosestrife
Barbara's Buttons
Bog Moss
Hop Clover
Sweet Clover
Creeping Cucumber
Partridge Perry
Indian Chick-weed
Horse Mint
Indian Pipes
Parrot Feather
Watercress
Yellow Lotus
Spatter-dock
Water-lily
Water-bananas
Evening Primrose
Wood Grass
Golden Club
Yellow Wood Sorrel
Violet Sour-grass
Water Dropwort
Maiden-cane
Panic Grasses
Pellitory
Whitlow-wort
Bahia Grass
Beard-tongue
Roadside Phlox
Ground-cherries
False Dragon-head
Pokeweed
Blue-flowered Butterwort
Yellow-flowered Butterwort
Small-flowered Butterwort
Watter-lettuce
Plantain

HERBS contd.

Marsh-fleabane
Rose Pogonia Orchid
Painted-leaf
Jointweed
Smartweed
Leaf-cup
Pickerel-weed
Portulaca
Lanceolate Pondweed
Grass-leaf Pondweed
Ovate-leaf Pondweed
Mermaid-weed
Scurf-pea
Black-root
Mock Bishop's-weed
False Dandelion
Wild Radish
Meadow-beauty
Beak Rushes
Baby Pepper
Black-eyed Susan
Dock
Narrow-leaved Arrowroot
Arrowroot
Glass-wort
Lyre-leaf Sage
Water-pimpernel
Snakeroot
Hooded Pitcherplant
Lizard-tail
Sensitive-brier
Wool-grass
Bulrush
Skullcap
Butterweed
White-top Aster
Sea-purslane
Foxtail Grass
Sleepy Catchfly
Blue-eyed Grass
Nightshade

HERBS contd.

Goldenrod
Bur-reed
Cord Grass
Venus' Looking-glass
Duck-weed
Smut-grass
Florida Betony
Chick-weed
Queen's-root
Wild-bean
Hoary-pea
Spanish-moss
Spiderwort
Clover
Dutch White Clover
Deer's Tongue
Cattail
Sea-oats
Bladderwort
Moth Mullein
Verbena
Narrow-leaved ironweed
Ironweed
Veronica
Vetch
Periwinkle
Florida Violet
Lance-leaved Violet
Seven-lobed Violet
Walter's Violet
Yellow-eyed Grass
Zephyr Lily

Source: Local Flora by Dana G. Griffin, III, Department of Botany, University of Florida, and Florida Cooperative Extension Service, IFAS, University of Florida, Gainesville, Florida. Mr. Mike Bordyn, Alachua County Forester.

APPENDIX 3
A PARTIAL LIST OF SELECTED
WILDLIFE SPECIES IN ALACHUA COUNTY

BIRDS

Wild Turkey	Bobwhite Quail
Wood Duck	Common Loon
Horned Grebe	Pieded-Billed Grebe
Double-Crested Cormorant	Anhinga
Great Blue Heron	Great Egret
Louisiana Heron	Little Blue Heron
Snowy Egret	Cattle Egret
Yellow-Crowned Night Heron	Black-Crowned Night Heron
Least Bittern	American Bittern
White Ibis	Glossy Ibis
Snow Goose	Wood Stork
Mallard	Fulvous Tree Duck
Black Duck	Mottled Duck
Pintail	Gadwall
Blue-Winged Teal	Green-Winged Teal
Shovler	American Widgeon
Redhead	Ring-Necked Duck
Lesser Scaud	Canvasback
Bufflehead	Common Goldeneye
Red-Breasted Merganser	Ruddy Duck
Turkey Vulture	Hooded Merganser
Swallow-Tailed Kite	Black Vulture
Sharp-shinned Hawk	Mississippi Kite
Red-Shouldered Hawk	Cooper's Hawk
Broad-Winged Hawk	Red-Tailed Hawk
Osprey	Marsh Hawk
*Peregrine Falcon	*Bald Eagle
Kestrel	Merlin
Limpkin	*Sandhill Crane
Virginia Rail	King Rail
Purple Gallinule	Sora
American Coot	Common Gallinule
American Golden Plover	Killdeer
Common Snipe	Woodcock
Spotted Sandpiper	Upland Sandpiper
Greater Yellowlegs	Solitary Sandpiper
Pectoral Sandpiper	Lesser Yellowlegs
Least Sandpiper	White-Rumped Sandpiper
Black-Necked Stilt	Dowitcher Sp.
Ring-Billed Gull	Herring Gull
Laughing Gull	Bonapartes Gull

Forrester's Tern
 Common Tern
 Black Skimmer
 Mourning Dove
 Yellow-Billed Cuckoo
 Barn Owl
 Great Horned Owl
 Burrowing Owl
 Whip-Poor-will
 Chimney Swift
 Ruby-Throated Hummingbird
 Pileated Woodpecker
 Red-Headed Woodpecker
 Hairy Woodpecker
 *Red-Cockaded Woodpecker
 Great Crested Fly Catcher
 Arcadian Flycatcher
 Tree Swallow
 Barn Swallow
 Bank Swallow
 Blue Jay
 Fish Crow
 Tufted Titmouse
 Brown Creeper
 Winter Wren
 Long-Billed Marsh Wren
 Mockingbird
 Brown Thrasher
 Hermit Thrush
 Gray-Checked Thrush
 Eastern Bluebird
 Golden-Crowned Kinglet
 Water Pipit
 Loggerhead Skrike
 White-Eyed Vireo
 Soliatry Vireo
 Black & White Warbler
 Worm-Eating Warbler
 Blue-Winged Warbler
 Orange-Crowned Warbler
 Yellow Warbler
 Cape May Warbler
 Yellow-Rumped Warbler
 Yellow-Throated Warbler
 Black Poll Warbler
 Palm Warbler
 Northern Waterthrush
 Kentucky Warbler
 Hooded Warbler
 House Sparrow
 Eastern Meadowlark

Black Tern
 Rock Dove
 Ground Dove
 Black-Billed Cuckoo
 Screech Owl
 Barred Own
 Chuck-Willis-Widow
 Common Night Hawk
 Belted Kingfisher
 Common Flicker
 Red-Bellied Woodpecker
 Yellow-Bellied Sapsucker
 Downy Woodpecker
 Eastern Kingbird
 Eastern Phoebe
 Eastern Wood Pewee
 Rough-Winged Swallow
 Cliff Swallow
 Purple Martin
 Common Crow
 Carolina Chickadee
 Brown-Headed Nuthatch
 White-Breasted Nuthatch
 House Wren
 Carolina Wren
 Short-Billed Marsh Wren
 Gray Catbird
 Wood Thrush
 Swainson's Thrush
 Veery
 Blue-Gray Gnatcatcher
 Ruby-Crowned Kinglet
 Cedar Waxwing
 Starling
 Yellow-Throated Warbler
 Red-Eyed Vireo
 Prothonotary Warbler
 Golden-Winged Warbler
 Tennessee Warbler
 Parula Warbler
 Magnolia Warbler
 Black-Throated Blue Warbler
 Blackburnian Warbler
 Chestnut-Sided Warbler
 Prairie Warbler
 Ovenbird
 Louisiana Thrush
 Common Yellow Throat
 American Redstart
 Bobolink
 Red-Winged Blackbird

Orchard Oriole
 Rusty Blackbird
 Bloat-Tailed Grackle
 Brown-Headed Cowbird
 Summer Tanager
 Rose-Breasted Grosbeak
 Indigo Bunting
 Dicksissel
 Pine Siskin
 Rufous-Sided Towhee
 Grasshopper Sparrow
 Backman's Sparrow
 Chipping Sparrow
 White-Crowned Sparrow
 Fox Sparrow
 Song Sparrow

Northern Oriole
 Brewers Blackbird
 Common Grackle
 Scarlet Tanager
 Cardinal
 Blue Grosbeak
 Painted Bunting
 Purple Finch
 American Goldfinch
 Savannah Sparrow
 Vesper Sparrow
 Dark-Eyed Junco
 Field Sparrow
 White-Throated Sparrow
 Swamp Sparrow

MAMMALS

Whitetail Deer
 Eastern Gray Squirrel
 Southern Flying Squirrel
 Eastern Harvest Mouse
 Rice Rat
 Florida Water Rat
 Marsh Rabbit
 Eastern Wood Rat
 Southern Golden Mouse
 Red Fox
 Normay Rat
 Grey Fox
 Bobcat
 *Florida Weasel
 Opossum
 Shorttailed Shrew
 Mississippi Mytosis (Bat)
 *Southeastern Shrew
 Least Shrew
 Oldfield Mouse
 Florida Mouse

Wild Hog
 Fox Squirrel
 Southern Pocket Gopher
 Cotton Mouse
 Cotton Rat
 Eastern Cottontail Rabbit
 Hispis Cotton Rat
 Nine Banded Armadillo
 House Mouse
 Striped Skunk
 Florida Panther
 Florida Black Bear
 Florida Otter
 Eastern Mole
 Seminole Bat
 Big-Eared Bat
 Black Rat
 Raccoon
 Eastern Spotted Skunk

Other endangered or threatened vertebrates of Alachua County include:

*American alligator
 *Indigo Snake
 *Short-tailed Snake
 *Florida Gopher Frog

*Threatened or Endangered Species List - Florida Game and Freshwater Fish Commission

List prepared by the Gainesville Office of the Florida Game and Freshwater Fish Commission and the Alachua County Red Flag Charette Committee, 1973.

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A.T. Andrews	-	Alachua County Agricultural Agent
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Steve Nesbitt	-	Alachua County Office of the Fla. Game and Fresh Water Fish Commission
Cary Pafford	-	Alachua County Health Department
E.C. Pirkle, PhD	-	Univ. of Fla., Dept. of Geology
Buster Thomas	-	Alachua County Soil Conservation Service

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Plan
Docs

Alachua County

AUTHOR
Natural Resources - 1975

TITLE

DATE DUE	BORROWER'S NAME
1/2/76	Mike Johnson 267-15-7129
1/8/76	Steve Llan 268-58-809
1/14/76	M. G. Gons 267-15-7129
1/13/76	MIKE NIEMINEN 265-2541
1/1/76	

